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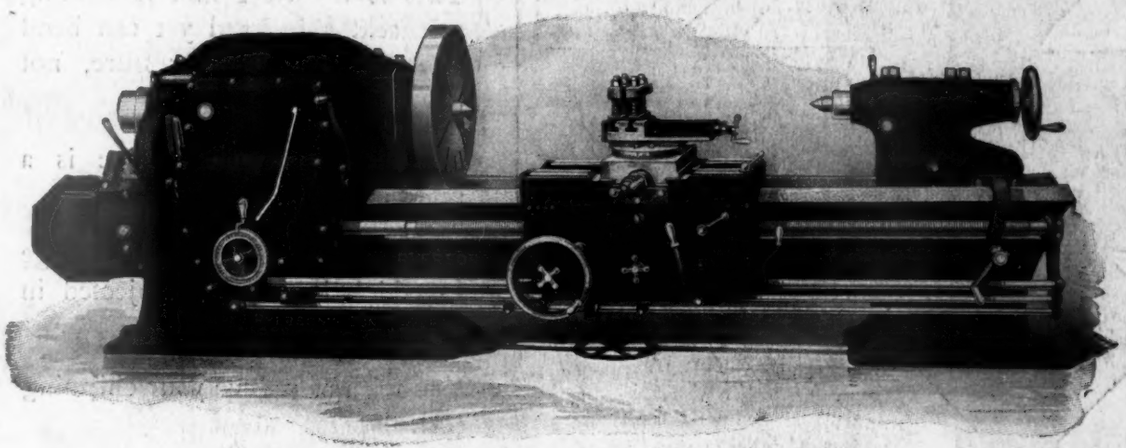

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Railway Mechanical Engineer

Volume 94 November, 1920 No. 11

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Systematizing Management in Railroad Shops

The systematic analysis of shop operations is a fairly recent development. It is an inevitable result of the increase in the size of individual plants which made it impossible for the supervisory officers to gain correct and definite information regarding the operation of the properties by personal observation. In many manufacturing plants the operations are few in number. This has facilitated the keeping of detailed records and has led to the introduction of time studies of the individual operations. At present, time studies and detailed records are the most important features of investigations of production in industry. Due to the diversity of the work in railroad shops, the introduction of these same methods involves an enormous amount of clerical work and for that reason many railroad shop men have contended that so-called scientific management methods could not be successfully used.

The argument against systematized management in railroad shops is based on objections to the methods used and not to the object to be attained. The records are the means to an end and are only useful for the results secured. Railroad shop executives who are trying to get increased output should recognize that systematic management methods have proved a great aid to industrial plants and should likewise be beneficial in railroad shops. There is no necessity for adopting the identical system that is used in industries, but by instituting a series of records that will check the progress of the work and insure that the various departments operate as a unit, troublesome delays can be avoided. The foremen could be relieved of a mass of routine duties, thus enabling them to give more time to developing improved methods and increasing the efficiency of their departments. Where no follow-up system is used in the shop, it will generally be found that the foremen spend a large part of their time trying to expedite the individual jobs. They have no means of knowing where the parts for the next locomotive that is due out have been delayed, why the storehouse has not delivered certain material, or any of the multitude of trivial matters that hold up production.

Most railroad shops are too large to function properly without some aids to management. Just how comprehensive a system is needed for a given shop depends on the size of the plant and the local conditions. At any rate, the time has come when railroad men should recognize that systematic management is needed and should attempt to apply the principles worked out in industry to the different conditions existing in railroad shops. Are you using a shop scheduling system?

Breaking Operating Records

The effect of the campaign of the Association of Railway Executives to secure improved operation of the railroads is quite evident in the records recently published by the American Railroad Association and the Interstate Commerce Commission. Statistics of the Car Service Division of the A. R. A. show that in the week ending October 9, 1,009,787 freight cars were loaded, a record that has been exceeded but once. This is the first time this year that freight car loading has passed the million mark although for several weeks the figures have been in excess of the loadings for the corresponding weeks in 1919 and 1918.

Operating statistics for the month of July show that the railroads during that month handled 15.2 per cent more freight than in July, 1919. In the first seven months of 1920 the number of tons of freight hauled one mile was 248,999,000,000 in spite of the handicap of the outlaw strikes. This is an increase of 17.1 per cent as compared with the first seven months of 1919 and also represents a greater volume of traffic than has ever before been handled by the railroads in the first seven months of the year. In July of this year the average tons of freight per car was 29.7 as com-

pared with 28 in 1919. The average mileage per freight car per day was 26.2 as against 24.1 last year.

While operating statistics for the later months are not available, the records of car loading already mentioned indicate that the performance is steadily improving. This is further shown by the fact that the accumulation of loaded cars in terminals awaiting movement, which was almost 100,000 on March 1 when the roads were returned, was reduced to 41,135 on October 8. As nearly 18,000 of these cars were being held at ports for ships, it is no exaggeration to state that congestions have ceased to exist.

The general freight car situation is also improving as shown by the fact that the car shortage for the week ending October 1 shows a reduction of 9,000 cars as compared with the previous week. Cars are being returned to the owners and on October 1, 30 per cent of the cars were on home lines, a gain of 2 per cent over September 1 and of 8.1 per cent over March 1. To offset these circumstances, however, the percentage of bad-order cars shows a slight increase from 7.0 per cent in June, 1920 to 7.2 per cent in July. Conditions are better than in July, 1919, when the percentage of bad-order cars was 8.7, but this was almost a high record and there is urgent need for more attention to car repairs in order that the unserviceable equipment may be brought down to the normal value of four per cent.

This record is splendid, but it can be still further improved by enthusiastic and intelligent co-operation of all of the departments on the railroads and of every man in each department. Mechanical department forces in particular can be a big factor in improved operation.

Accident Investigation Discloses Disregard of I.C.C. Rules

The chief inspector of locomotive boilers has recently reported to the Interstate Commerce Commission a crown sheet failure on a passenger train which resulted in the death of the engineer and fireman. The circumstances are somewhat unusual in that the investigation disclosed several flagrant violations of the provisions of inspection rules. The accident occurred on a Pacific type locomotive drawing a passenger train and while running at a speed of about 45 miles an hour. The crown sheet failed, permitting steam and water to enter the cab and resulting in fatal injuries to both members of the crew. The locomotive was built in 1913 and had a straight top radial stayed boiler supported by 1⅛ in. stays, spaced 4 in. by 4 in. The crown sheet pocketed to a depth of 4 in. on the right side. In the pocketed area there were 37 broken bolts, 12 which were not broken which the sheet pulled off. Numerous defective stays were found outside the pocketed area. No evidence of overheating or strain was found, but after the pocketed section of the plate was cut cut, an examination of the broken bolts showed that the ends were coated with considerable scale. From the appearance of the rest of the boiler, it was believed that these stays were broken some time previous to the last monthly inspection, which was made 20 days prior to the accident.

Investigation disclosed that on the previous trip, the safety valves did not relieve the pressure and it went as high as 250 lb. Nevertheless the inspectors did not believe that this was a factor in causing the accident as the stresses on the crown stays would have been well within the allowable limit.

The inspector who certified to the condition of the boiler at the last monthly inspection admitted that he did not perform the work called for on the report and that the locomotive was not fired up although the report stated that the safety valves were set on that day. It was also brought out that in setting the safety valves on the day of the accident a second steam gage, as required by law, was not used.

In commenting on the accident, the chief inspector calls attention to the laxity of the mechanical department officers in assigning men to make inspections without knowing that they were capable of performing such work and for not supervising the work to see that the requirements of the rules were complied with. Attention is directed to the fact that the fatalities might have been avoided had the locomotive been equipped with automatic firedoors, and the use of tell-tale holes in all crown stays and staybolts, regardless of their length, is recommended.

Better Freight Cars Needed

The railroads, spurred on by the necessity of moving an unprecedented amount of freight in order to prevent a heavy curtailment of production, have made a remarkable record during the past few months. The goals which were established by the Association of Railway Executives included an average movement of each loaded freight car of 30 miles per day, with an average loading of 30 tons. During July the roads averaged 26 miles per car per day. During that month 12 of the large roads exceeded the standard for car loading and 15 roads attained an average of over 30 miles per car day. The splendid service which has been done by the car service committees and the car service organization has made it possible to break up the congestions at different points and to secure a more normal freight car movement.

One thing is interfering greatly with getting a better movement, and that is that so many of the freight cars are in poor condition. Some of them are too light and should have been retired from service long ago, and a great many others, if they are to remain in service, must be rebuilt and be very considerably reinforced. It is poor policy to try to continue to operate cars which cannot stand up under service. It means that heavy trains are continually being delayed because of defective cars and in many cases these breakdowns have wrecked good cars and have damaged or destroyed considerable amounts of freight. The mechanical department should use every influence to get the cars into good operating condition, or to see that they are set aside if they are not fit.

Use of Wired and Safety Glass

So large a proportion of the injuries sustained as a result of the bomb explosion which occurred recently in Wall street were directly due to broken glass falling from the shattered windows, that there was much speculation as to the extent to which these injuries would have been lessened had the use of wire glass been more general. Every accident from a broken windshield resulting from even slight automobile mishaps invites similar consideration in favor of the use of safety glass. While broken glass does not figure prominently in railroad accidents, the menace is always present.

With the wide use of wire glass and the improvement that has more recently been effected in the construction of safety glass, there is no reason why the special properties possessed by both of these materials should not be more generally taken advantage of in car and locomotive use as well as in shops, stations and office buildings.

Safety glass consists of two layers of ordinary glass cemented together, so that when struck a sharp blow it will not shatter into many flying fragments, although it may be badly cracked. When first manufactured safety glass did not have altogether satisfactory visibility, but this has been remedied and its use for automobile windshields has become popular. The same arguments in favor of its use in an automobile windshield should apply to its use in a locomotive cab; if you are willing to pay the extra price for this form of protection in your automobile, would it not be consistent to place the same glass in the locomotive cab? The use of any material that promises additional protection to employees is something to which mechanical engineers should always give serious consideration.

DO YOU KNOW YOUR MEN?

WILLIAM S. WOLLNER, general safety, fire prevention and welfare agent of the Northwestern Pacific, in an address before the October meeting of the New York Railroad Club on The Human Element in Railroading, drew a sharp contrast between the critical attention which is given to the selection and use of materials on the railroads and the comparative indifference which is paid to the selection and use of a far more vital factor—the men. Is it not true that this lack of appreciation of the necessity for using special skill and scientific methods in directing the human element is at the bottom of most of the labor difficulties which beset us?

Training the Foremen

A large part of the leadership on the railroads, even outside of those departments which have to do with civil, mechanical and electrical engineering problems, is in the hands of technically educated men. Young men who enter engineering courses in our colleges look forward, most of them, to the time when they will be advanced to executive positions and will have considerable forces of men working under their direction, and yet, even today, how many of our engineering courses give any adequate amount of attention to problems affecting the utilization and direction of human energy? It is true that the technical graduate today is better favored in these respects than those of us who were graduated several years ago, but even at that, in most cases, he is little better fitted in this respect when he is graduated than he is of using good English and sound logic in making up an engineering report.

On the other hand, how much real coaching or training does a foreman receive in the supervising of men when he is promoted from the ranks? He may have the highest sort of ability in this respect lying dormant, but of what use is this unless he knows how to utilize it? A cutting tool may be made of the finest kind of steel, but if it is not properly sharpened for the work which it is to do, it is inefficient and oft-times useless.

A few industries have awakened to the vital necessity of educating their foremen and subordinate officers in the art of training men and directing their work and they are getting big returns from an almost insignificant expenditure. Ordinarily a foreman or boss in railroad service is taken from the ranks and is literally thrown at the job. In some cases hs fails miserably when he could have made good under intelligent direction. In other cases he stumbles along and manages to get by, but like Topsy, he "just grows up" to the job and the limited education that he receives from bitter experience costs his company heavily. In a few cases the new foreman has a rare ability as a director of men and makes good from the start, but even these men would do better and go further if aided by a comprehensive and intensive course of study. An ordinary mechanic serves four years as an apprentice to perfect himself in handling a few tools and doing a limited number of mechanical jobs. On the other hand, a foreman who must direct men, the biggest and most complex factor in production, receives no special training. Is it not logical that when a man is selected for promotion he should at least receive a course of training in the art of handling men which will take as long a time as learning how to operate a typewriting or calculating machine, and yet, whoever heard of this being done on a railroad?

If the individual railroads cannot see their way clear to provide proper training courses for such men in the various departments, why not have the roads combine into groups? Or possibly the American Railway Association could arrange to provide the necessary courses and training schools. And why should the American Railway Association not do this? At present it is concentrating all its energies on securing the best use of the present facilities, and yet, what course could the association take which would do so much in this direction as seeing that the supervising officers were all suitably instructed and equipped in the art of handling men?

Labor Turnover

In discussing Mr. Wollner's paper J. C. Clark, assistant to the general manager of the Oregon Short Line, directed attention to the great waste on the railroads because of the excessive labor turnover. The labor turnover is a symptom of a disease and in order to locate the cause and eliminate it a thorough and scientific analysis must be made of the reasons why men leave the service. Incidentally, if the railroads realized the great expense to which they are put in breaking in new men they would be inspired to locate the weak spots in the organization and strengthen them, even at a very considerable cost. Many industries have thoroughly analyzed the labor turnover with excellent results. Railroads are not very different from industries in general and they should take advantage of what has been done in other fields. But where are the men of vision in the railroad field who will take the initiative and not only make such studies, but follow them up and take advantage of them?

Master Workmen

The railroads have made remarkable progress in speeding up transportation and in getting the maximum use out of the present limited facilities. They will, however, have to do even more if the prosperity of the country is to go forward. If the roads do not get more use from the present equipment some of our people will have to undergo much suffering. In the last analysis, however, all of the people will feel the effects. Inefficient workmen, or skilled workmen who deliberately restrict production, may feel that they are justified in their position and that they are taking it out of the bosses or the stockholders. Under modern industrial conditions, however, we have grown so interdependent that one part of our people cannot be hurt without the entire population being affected.

The New York Tribune has just published a copyrighted series of articles by Marshall Olds on The High Cost of Strikes. The following paragraph is significant:

"American public sympathy has always been, naturally and openly, on the side of labor, because its struggles were so frequently against the same big industrial 'robber barons' which the public itself was fighting and because in general in its fight with capital, labor seemed to be the under dog. But labor's overconfident, often almost mad, insistence in flaunting its fundamental doctrine of class rights, its increasingly ruthless and open infringement of the most basic and important rights of all the people to be fed and warmed and clothed, in order that some small group of the labor class may be able to draw full pay for working three days a week or in order to put one group of men instead of another group into union power, is an open challenge as to whether America is to go back to the class and group government of the Middle Ages for the benefit of some of the people, or is to stay American for the benefit of all Americans."

Wise, intelligent supervision, patient effort and simple educational measures will do much to bring those elements that are abusing their power to their senses. Fortunately the American railway workers are above the average of industrial workers in this country. We will never get anywhere, however, if those who direct them are not big enough and sufficiently well trained to know how to deal with them properly, and wisely direct their energies. If we are to have master workmen we must have expert and master foremen and executives, and the higher executives especially must have a keen and broad appreciation of the importance of the human element in the organization.

COMMUNICATIONS

ASSIGNING LOCOMOTIVES

PHILADELPHIA, PA.

TO THE EDITOR:

The proverbial man from Mars, if he were to observe our railroads, could not fail to wonder at the assignment of engines to trains. Often locomotives are distributed seemingly as though any engine would fit any train. When the project for standard engines was under way during the war, one of the chief arguments against them was that they would not fit any particular set of operating conditions. But could the assignment of these engines to any particular division be more out of place than the assignment of engines to some trains on which they are regularly placed? I have seen within a half hour on the same piece of track a heavy Pacific engine go by hauling a four car passenger train and a light Atlantic engine loaded down with a full tonnage freight train, about twenty box cars. The Atlantic engine could easily have handled the passenger train—it had in times gone by—and as a freight engine, the Pacific could have handled practically the same tonnage as the Consolidations and done it faster.

Not many hours before writing these lines, I saw one of the finest Pacific engines in the country hauling a little local train into the station, a train any eight-wheeler could have handled. I do not believe that this road is short of eight-wheelers, it always has plenty around the repair shop farm; but it hauls plenty of little local trains with Atlantic and Pacific engines. Frequently Mogul engines are used on the same service, and I have become hardened to the sight of a Consolidation engine on passenger trains. There is even one local passenger train that I can expect to see with a Mikado.

Why should a little engine go out hauling a big train and right behind it come a little train with a big engine? Why should freight train after freight train pass, all with about the same tonnage, but with all sizes of engines? Why should a thirty-five car train have one engine and a forty-car train be double-headed? Why should some divisions have all small engines when some large ones could be used, and others have all large engines when smaller ones could be used to advantage on some of the trains?

Why should not the responsibility for the assignment of engines be placed squarely on somebody's shoulders, he to look after the location of the present power and its general assignment to trains and to have the further duty of continually investigating operating conditions with a view to developing new sizes of power to meet the requirements? He should aim as far as possible to have the right engine on the right train, shifting the engines from roundhouse to roundhouse until the best results are obtained.

It is a difficult problem, and, in general, at present is nobody's business. The superintendent of motive power has too much to do. The master mechanics are glad to keep the engines in running order. The road foreman of engines is glad to keep them going after they are turned over to the operating department. He has his hands full to keep the engines in order and scrape up an engine now and then when they get real scarce. The roundhouse foreman often is satisfied if he has any engine at all for each train. I have seen a little eight-wheel engine weighing not over 100,000 lb. go out with a seven-car express train that would have taxed the capacity of an Atlantic of twice the size. Why? It was the only engine of that division that happened to be in the house. I have seen the roundhouse foreman wonder whether any passenger engine would come in that was fit to send out on the limited in the morning, or whether he would in the end have to use the best freight engine in the house. As far as the operating department is concerned, any engine that is big enough to haul the train will do.

It is very bad policy not to distribute the motive power to the best advantage. It costs extra money to handle little trains with big engines; it may cost extra money to handle big trains with little engines, and it is certainly unsatisfactory to all of us who have been late because the engine could not handle the train. Here lies an opportunity for increased efficiency! Why should not the job be given to a particular officer, who would have to know the whole road, the weight of trains, profile, condition of track, the characteristics and condition of each engine on the road, the train schedule, and all the other things that affect the problem, and from these things plan the distribution of motive power, keeping an eye on the order in which the engines go into the shop so as not to get stuck at any time for a particular class of engine and, in general, see that the right engine is always available and used so that we will not be treated to the spectacle of 150,000 lb. Consolidations and 320,000 lb. Mikados hauling the same weight train over the same track.

GEO. N. CLOUSER.

SHOP LABOR CONDITIONS

NEW YORK, N. Y.

TO THE EDITOR:

Labor conditions generally are improving slowly. There is still much to be done before getting back to the conditions that existed before the war. The movement now on foot by the labor leaders to nationalize the railroads through National Agreements and National Boards of Adjustment is of vital importance to the public.

If this movement goes through the present indications of there being a betterment will be reversed. Much depends on just what is done in the next few months. The time is opportune for shaking off a big per cent of the things that hamper improving conditions.

Most shops have on their hands a lot of mechanics with little or no skill; men who were employed during the war period when good men were unobtainable. These partially skilled men who have not showed any aptitude for improvement must be weeded out and good men put in their places. This move cannot be made unless there is either a marked modification made in the National Agreement on seniority rights or an arbitrary stand taken to disregard entirely all the rules and working agreements that were put in force by the Railroad Administration during government control.

Certainly the spirit of the Transportation Act was to restore each individual road to an individual operating unit so that they might deal with their own men independently, without being hampered in any manner by political influence. National Boards of Adjustment will mean a continuation in a marked degree of the conditions that built up step by step the inefficient machine that must now be rebuilt in its entirety. The public has a right to an efficient transportation machine. The roads gave them one before the war period; they can do it again if unhampered and again placed in the position of individual units so that each one's labor problems may be worked out and solved by the local officials.

The right to re-establish either the piece work system, bonus or merit system is of paramount importance. The National Agreement method of paying all men alike regardless of their skill or production capacity is entirely wrong; it can only lead to one thing—inefficiency. This octopus must be shaken off. The good workmen in the railroad shops never favored this method of rate fixing and do not favor it now. There are now lots of men looking for employment. The time is ripe for something to be done; the start must eventually be made. Why postpone the inevitable?

F. OREMAN.

MOUNTAIN TYPE LOCOMOTIVES FOR THE NEW HAVEN

Equipment Includes Feed Water Heaters and Provision for Future Application of the Booster

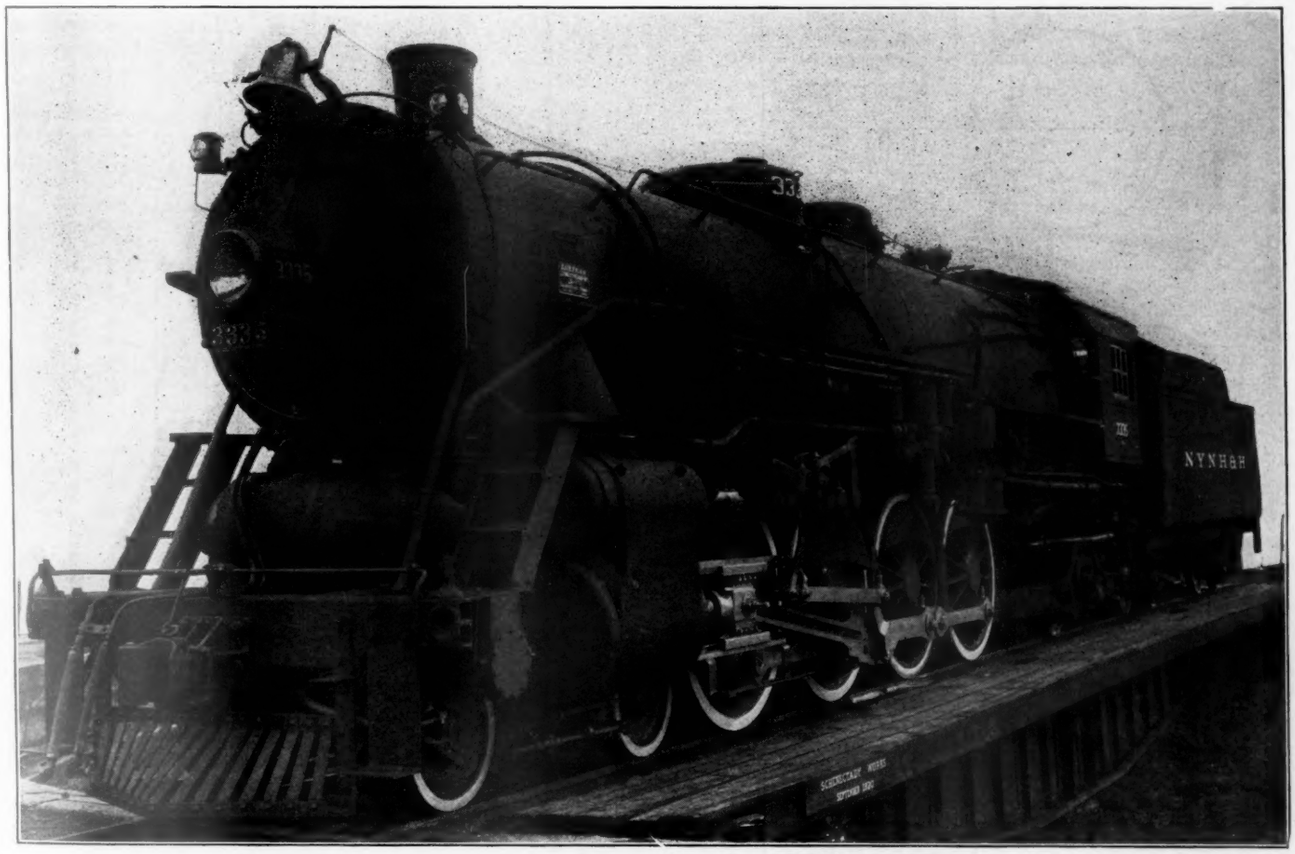
THE New York, New Haven & Hartford has purchased 30 Mountain type locomotives from the American Locomotive Company following closely in design the U. S. R. A. standard light Mountain type locomotives delivered to that railroad by the same builders during federal control. The new locomotives were built at the Schenectady works of the American Locomotive Company. The selection of this type for freight service is particularly significant in view of the fact that the railroad has also had experience with Mikado and Santa Fe type locomotives of recent design.

The construction of a large, well-designed classification yard at Cedar Hill, near New Haven, Conn., which was described in the July 30, 1920, issue of the Railway Age has placed the New Haven in a better position to utilize heavy power in freight service. It has always been a difficult matter on the New Haven to assemble heavy tonnage trains regularly for through movement on account of the character of the territory served and it may be possible that the potential tonnage rating of the Santa Fe type locomotives would be in excess of the practical limitations on this section on the line. On the other hand, the Mountain type should be able to demonstrate sustained speed with full tonnage trains in excess of the Mikado type locomotives.

The new Mountain type locomotive will operate mainly in through service between New Haven and Providence, a distance of approximately 110 miles. As this portion of the railroad is a two track line over which moves a large portion of the fast passenger service between New York and Boston, the necessity for a locomotive that can handle these freight trains at sustained speed is apparent.

Performance Characteristics

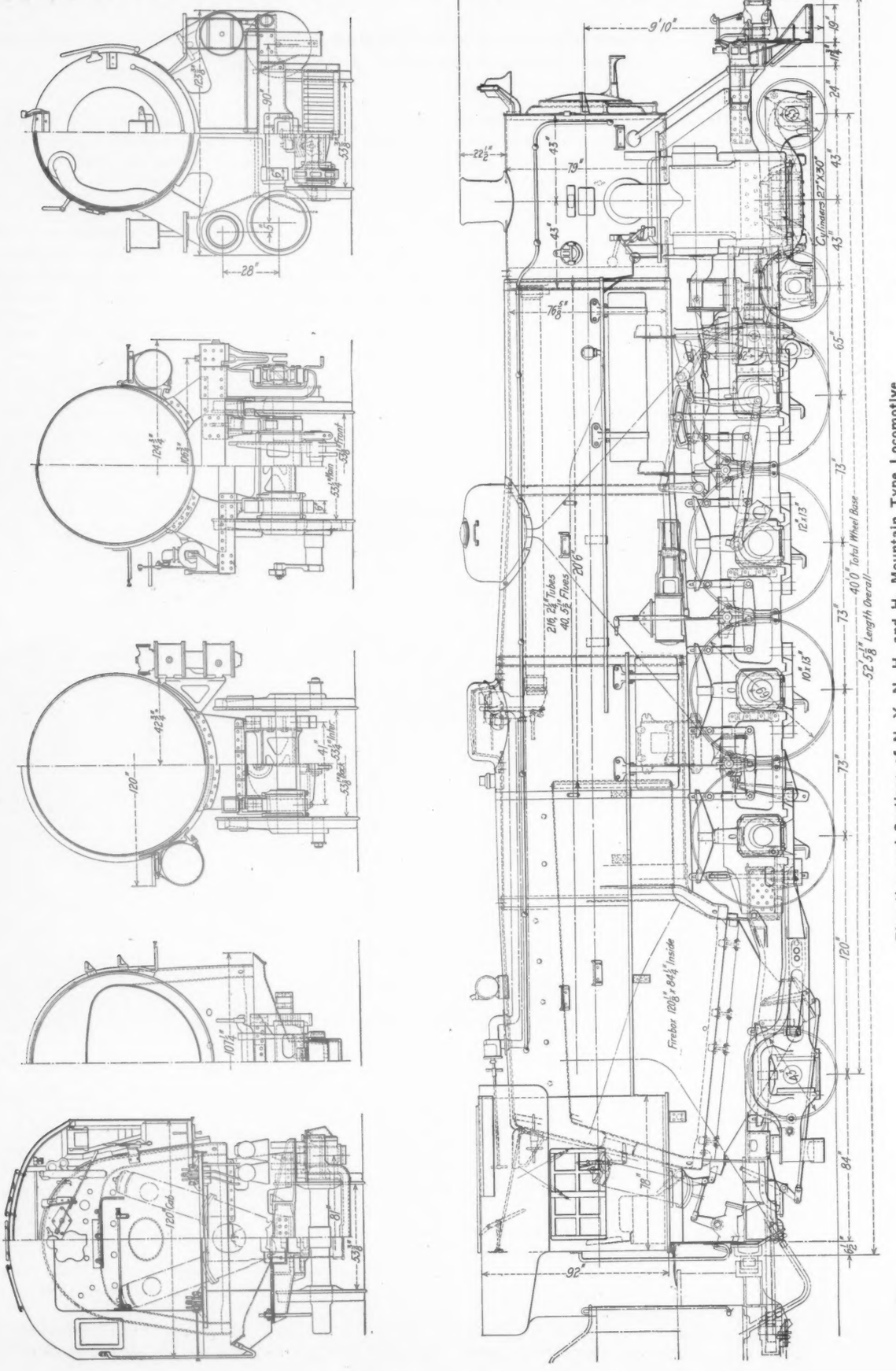
The light Mountain type was the last of the standard designs to be prepared by the Railroad Administration but the first of these locomotives completed by the American Locomotive Company was consigned to the New Haven. The performance of these first Mountain type locomotives has been generally satisfactory and the new locomotives do not differ from them in any marked degree except for the addition of several important specialties designed to increase the efficiency and capacity of the new locomotives.



Mountain Type Locomotive for Fast Freight Service

The locomotives will exert a maximum tractive effort of 53,900 lb. The line over which these locomotives will operate is along the shore of Long Island Sound and is practically level except for a few short breaks with a maximum of 0.6 per cent for a short distance. As the tonnage handled by these locomotives will be approximately 3,000 tons, they should be able to handle a large volume of through freight in conjunction with the heavy passenger traffic.

Based on the performance of the earlier Mountain type locomotives it is anticipated that the new locomotives will be



Elevation and Sections of N. Y. N. H. and H. Mountain Type Locomotive

able to operate on an average monthly fuel consumption of not to exceed 135 lb. of coal per 1,000 ton-miles. The locomotives will, of course, make a very much better fuel performance between terminals and although these locomotives have been in service only a short time, they have already shown remarkable economy in the use of fuel. A close record is being kept of their performance and three of the locomotives recently effected an average record of 62 lb. of coal per 1,000 ton-miles between terminals with an average train load of 2,968 tons. One of these locomotives was equipped with a feedwater heater which is part of the regular equipment applied to five of these locomotives.

Changes in the Standard Design

The general dimensions of the new locomotives are practically identical with the U. S. R. A. standard light Mountain type locomotives described in the July, 1919, issue of the *Railway Mechanical Engineer*. The boiler and firebox are the same with the exception of a small increase in the number of staybolts applied and an increase in superheater heating surface from 966 sq. ft. to 1,009 sq. ft. The engine truck presents the first noticeable departure; this is of the constant resistance type with Commonwealth cast steel truck frame. Wheel dimensions are the same but the distribution of weight is changed as shown in the following table:

Light Mountain type locomotive

	New N. Y., N. H. & H.	U. S. R. A. standard
Total weight, lb.	328,500	327,000
Weight on drivers, lb.	229,000	224,500
Weight on engine truck, lb.	47,000	49,500
Weight on trailing truck, lb.	52,500	53,000

The important specialties applied to these locomotives include the following: Duplex stoker, Franklin firedoor, Franklin grate shaker, Radial buffer and Unit drawbar, Alco flexible staybolts (1773 applied), Chambers throttle valve (modified design), Lewis power reverse, and Southern valve gear.

The cylinders are cast with by-pass value chambers to permit the future application of the railroad company's standard by-pass valves.

Application of Feedwater Heater

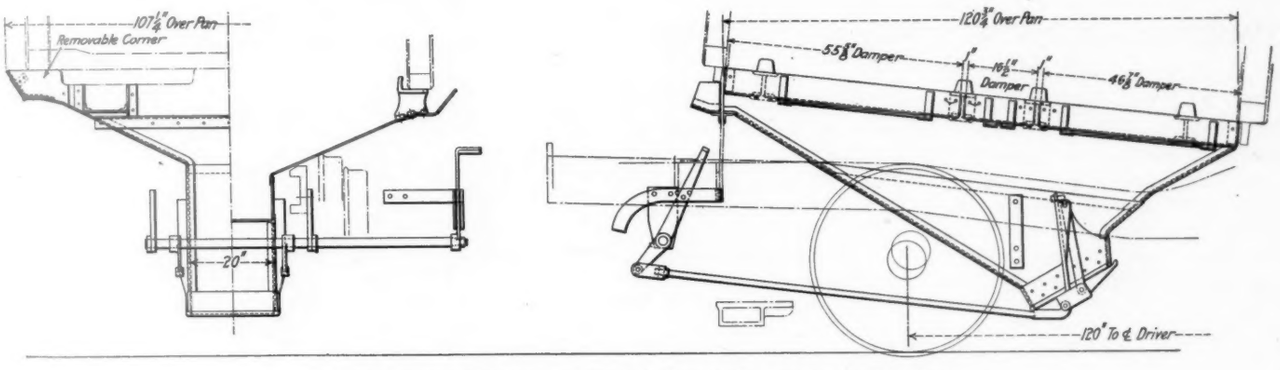
The feedwater heater and feedwater pump is an important addition to these locomotives. The apparatus has been applied to five engines and the arrangement of the running board and air pumps on the left hand side of the remaining 25 locomotives is such as to facilitate the application of this device at a later date. The Locomotive Feedwater Heater Company's standard apparatus is used. This includes a type E-1 heater and a 6½ in. pump having a capacity of approximately 7,500 gal. an hour.

The railroad has adopted an open-minded attitude toward the application of feedwater heaters. The fuel problem is acute on the New Haven and it is realized that every possible effort must be made to obtain the maximum service from every pound of coal. Feedwater heaters of the exhaust steam type appear to offer possibilities for a very large fuel saving particularly on the long level pulls where the locomotives will be continuously exhausting steam.

Future Application of Booster

The application of a booster to the trailing truck of these locomotives should materially increase the maximum tractive effort available for starting trains and might eliminate the services of a pusher used in assisting the trains over Branford Hill, a short distance out of the Cedar Hill yard. The railroad has probably had this in mind in providing for the future application of the booster to the extent of equipping all of the locomotives with trailing truck axles so designed that booster gears can be applied without necessitating new axles. The trailing truck is of the Woodward-Commonwealth type and the trailing truck brake is also arranged for the possible future application of the booster.

The most interesting detail in this connection is the use of a single hopper ashpan. The base of the pan slopes forward to a single drop door in advance of the trailer truck axle. The purpose of this design was to facilitate the application of the booster, although it appears that a further change would have to be effected in the design in order to provide sufficient clearance for the booster mechanism.



Single Dump Ash Pan Designed to Facilitate Booster Application

Principal Dimensions

The principal dimensions and data for these locomotives are as follows:

GENERAL DATA

Construction number	62205—34
Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bituminous coal
Tractive effort	53,900 lb.
Weight in working order	328,500 lb.
Weight on drivers	229,000 lb.
Weight on leading truck	47,000 lb.
Weight on trailing truck	52,500 lb.
Weight of engine and tender in working order	511,000 lb.
Wheel base, driving	18 ft. 3 in.
Wheel base, total	40 ft. 0 in.
Wheel base, engine and tender	75 ft. 7½ in.

RATIOS

Weight on drivers ÷ tractive effort	4.25
Total weight ÷ tractive effort	6.1
Tractive effort × diam. drivers ÷ equivalent heating surface*	660
Equivalent heating surface* ÷ grate area	80.1
Firebox heating surface ÷ equivalent heating surface* per cent	6.2
Weight on drivers ÷ equivalent heating surface*	40.7
Total weight ÷ equivalent heating surface*	58.3
Volume both cylinders	19.9 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	283.2
Grate area ÷ vol. cylinders	3.5

CYLINDERS

Kind	Simple
Diameter and stroke	27 in. by 30 in.

VALVES

Kind	Piston
Diameter	14 in.
Greatest travel	7 in.
Steam	1¼ in.
Exhaust clearance	3/16 in.
Lead	¼ in.

WHEELS

Driving diameter over tires	69 in.
Driving journals, main, diameter and length	12 in. by 13 in.
Driving journals, others, diameter and length	10 in. by 13 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	6½ in. by 12 in.
Trailing truck wheels, diameter	43 in.
Trailing truck, journals	9 in. by 14 in.

BOILER

Style	Conical, connected
Working pressure	200 lb. per sq. in.
Outside diameter of first ring	78 in.
Tubes, number and outside diameter	216—2¼ in.
Firebox, length and width	120⅛ in by 84¼ in.
Firebox plates, thickness	Tube and throat, ½ in.; others, ⅜ in.
Firebox water space	Front, 6 in.; others, 5 in.
Flues, number and outside diameter	40—5½ in.
Tubes and flues, length	20 ft. 6 in.
Heating surface, tubes	2,597 sq. ft.
Heating surface, flues	1,176 sq. ft.
Heating surface, firebox, including arch tubes	348 sq. ft.
Heating surface, total	4,121 sq. ft.
Superheater heating surface	1,009 sq. ft.
Equivalent heating surface*	5,635 sq. ft.
Grate area	70.3

TENDER

Tank	Water leg
Frame	Cast steel
Weight	182,500 lb.
Wheels, diameter	33 in.
Journals, diameter and length	6 in. by 11 in.
Water capacity	10,000 gal.
Coal capacity	16 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

COMMITTEE APPOINTMENTS OF MECHANICAL DIVISION, A. R. A.

The American Railway Association has recently issued a list of the standing and special committees appointed by the General Committee to serve until June, 1921. The committees have been given alphabetical designations as well as names. Those committees having a number after the designating letter are considered a part of the committee whose letter they bear and the chairmen of such committees are expected to attend meetings of the main committee. A list of the committees and the chairmen is given below.

Standing Committees

A—Arbitration. T. H. Goodnow (Chairman), superintendent car department, Chicago & North Western, Chicago.

A-1—Prices for Labor and Material. A. E. Calkins (Chairman), superintendent rolling stock, New York Central, New York.

B—Arrangements. W. J. Tollerton (Chairman), general mechanical superintendent, Chicago, Rock Island & Pacific, Chicago.

C—Autogenous and Electric Welding. J. T. Wallis (Chairman), chief of motive power, Pennsylvania System, Philadelphia.

D—Car Construction. W. F. Kiesel, Jr. (Chairman), mechanical engineer, Pennsylvania System, Altoona, Pa.

D-1—Brake Shoe and Brake Beam Equipment. W. J. Bohan (Chairman), assistant general mechanical superintendent, Northern Pacific, St. Paul, Minn.

D-2—Couplers and Draft Gears. R. L. Kleine (Chairman), assistant chief of motive power, Pennsylvania System, Philadelphia.

D-3—Train Brake and Signal Equipment. T. L. Burton (Chairman), consulting air brake engineer, New York Central, New York.

E—Car Wheels. W. C. A. Henry (Chairman), general superintendent motive power, Pennsylvania System, St. Louis, Mo.

F—Committees. T. H. Goodnow (Chairman), superintendent car department, Chicago & North Western, Chicago.

G—Locomotive Construction. H. T. Bentley (Chairman), superintendent motive power and machinery, Chicago & North Western, Chicago.

G-1—Design and Maintenance of Locomotive Boilers. G. H. Emerson (Chairman), chief of motive power and equipment, Baltimore & Ohio, Baltimore, Md.

G-2—Feed Water Heaters for Locomotives. F. M. Waring (Chairman), engineer tests, Pennsylvania System, Altoona, Pa.

G-3—Fuel Economy and Smoke Prevention. William Schlafge (Chairman), mechanical manager, Erie, New York, N. Y.

G-4—Mechanical Stokers. M. A. Kinney (Chairman), superintendent motive power, Hocking Valley, Columbus, Ohio.

H—Loading Rules. R. L. Kleine (Chairman), assistant chief of motive power, Pennsylvania System, Philadelphia, Pa.

I—Manual. W. E. Dunham (Chairman), assistant superintendent motive power and machinery, Chicago & North Western, Chicago.

J—Nominating. F. W. Brazier (Chairman), assistant to general superintendent rolling stock, New York Central, New York.

K—Safety Appliances. C. E. Chambers (Chairman), superintendent motive power and equipment, Central Railroad of New Jersey, Jersey City, N. J.

L—Specifications and Tests for Materials. F. M. Waring (Chairman), engineer tests, Pennsylvania System, Altoona, Pa.

M—Subjects. Willard Kells (Chairman), general superintendent motive power, Atlantic Coast Line, Wilmington, N. C.

N—Tank Cars. A. W. Gibbs (Chairman), chief mechanical engineer, Pennsylvania System, Philadelphia, Pa.

Special Committees

O—Amalgamation of Other Mechanical Organizations with Section III-Mechanical, of the American Railroad Association. W. O. Thompson (chairman), general superintendent rolling stock, New York Central, Buffalo, N. Y.

P—Car Repair Shop Layouts. I. S. Downing (Chairman), general master car builder, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.

Q—Design, Maintenance and Operation of Electric Rolling Stock. G. C. Bishop (Chairman), superintendent motive power, Long Island railroad, Richmond Hill, N. Y.

R—Engine Terminals, Design and Operation. C. E. Fuller (Chairman), superintendent motive power and machinery, Union Pacific, Omaha, Neb.

S—Lateral Motion on Locomotives. Willard Kells (Chairman), general superintendent motive power, Atlantic Coast Line, Wilmington, N. C.

T—Locomotive Headlights and Classification Lamps. W. H. Flynn (Chairman), superintendent motive power, Michigan Central, Detroit, Mich.

U—Modernization of Stationary Boiler Plants. L. A. Richardson (Chairman), mechanical superintendent, Chicago, Rock Island & Pacific, Des Moines, Iowa.

V—Scheduling of Equipment Through Repair Shops. Henry Gardner (Chairman), corporate mechanical engineer, Baltimore & Ohio, Baltimore, Md.

W—Standard Blocking for Cradles of Car Dumping Machines. J. McMullen (Chairman), superintendent car department, Erie, New York, N. Y.

X—Standard Method of Packing Journal Boxes. C. J. Bodemer (Chairman), assistant superintendent machinery, Louisville & Nashville, Louisville, Ky.

Y—Train Lighting and Equipment. J. R. Sloan (Chairman), chief electrician, Pennsylvania System, Pittsburgh, Pa.

Z—Train Resistance and Tonnage Rating. O. P. Reese (Chairman), superintendent motive power, Pennsylvania System, Toledo, Ohio.

THE PROBLEMS OF THE SUPERVISING OFFICERS*

Their Duties and Responsibilities Under Private Railroad Management; Organization of Foremen

BY SAMUEL O. DUNN

Editor, Railway Age and Vice-President Simmons-Boardman Publishing Co.

THE invitation of your president to talk to you made me anxious to avail myself of the opportunity to come here and meet you. I was much gratified when, in our conversation your president, Mr. O'Neill indicated he was familiar with the editorial policy which always has been followed by the Railway Age, the *Railway Mechanical Engineer,* and the other railway papers of which I am editor-in-chief, in the discussion of the problems of the railway supervising officer. It has been our uniform policy to urge upon the managements of the railways the wisdom of employing an adequate number of supervising officers in all departments, and of paying them salaries commensurate with their duties and responsibilities. As you know, the struggles between the railroad labor organizations and the railway companies have in the past frequently resulted in some conductors, locomotive engineers and other employees being paid wages exceeding the salaries of shop foremen, trainmasters, yardmasters and other officers having supervision over their work. In the editorial columns of our papers, we have contended that only in very exceptional cases could there be any justification for any employee in the ranks being paid higher wages than the supervising officers—that the efficiency of operation and justice to the supervising officers demanded that in almost every case the supervising officer's compensation should exceed, and substantially exceed, the wage of any of his subordinates. We took this position when the railways were under private operation. We took it when they were under government control. We have taken it since they have been returned to private operation.

In view of these facts, it has been a source of some gratification to me that immediately after the recent large advance in wages to employees was granted by the Railroad Labor Board the Association of Railway Executives voluntarily took up the general question of the salaries of supervising officers and urged the managements of the individual lines promptly to revise them on a basis which would make them reasonable and fair as compared with the new wages to be paid to the employees. I do not know how many railway managements have followed this advice, but I have no hesitation in saying that it is advice which every railway management ought to follow.

The Position of Supervising Officers

The supervising officers of all classes, and in the mechanical, maintenance of way and transportation departments especially, are the points of contact between the railway managements, on the one hand, and the employees, on the other. It is, under private ownership, the function of the management to determine the policies adopted in the development, maintenance and operation of the railways. It is the function of the supervising officers to see that the employees work in such a manner as efficiently to carry out these policies.

The position of supervising officers, under present conditions, is one of difficulty and delicacy. There is more or less uncertainty in the minds of many supervising officers in regard to their proper relations to the owners and managers, on the one side, and the employees, on the other. Naturally it is the desire of all supervising officers to make their own situation as favorable as practicable with respect both to conditions of employment and compensation. There is, unfortunately, a large amount of antagonism between the managements, on the one side, and the labor unions, on the other. Placed as they are between these two elements, many supervising officers question whether it is their duty and to their interest to identify themselves principally with the managements, on the one side, or the organized employees, on the other.

Should Supervisors Be Identified with the Unions?

I think we can agree that the fundamental need of all of us—the railway managements, supervising officers, employees and the public—is that the railways shall be adequately developed and shall be operated as efficiently as possible. I mean by adequately developed, that their facilities shall be sufficiently increased to enable them satisfactorily to handle all the traffic that the American people and American industries can produce and offer to them. By efficiently operated I mean, so operated that the very greatest practicable service will be obtained from every ton of material and fuel used, from every mile of track, every locomotive and every car, and that every officer and employee shall do the most and the best work he can consistent with having reasonable hours of work and maintaining himself in good health. The railways are one of the most important parts of our national machinery of production. The efficient operation of all our machinery of production is essential to increasing our production of the necessities, comforts and luxuries of life. An increased production of the necessities, comforts and luxuries of life is essential for the promotion of the welfare of all of us, and especially of the working classes themselves. The second point upon which I think we can agree is that we should adopt on our railways, and in our other industries, not only that system which will secure the greatest practicable production, but also that system which will secure the most equitable division of what is produced among all who participate in producing it.

But under what system of ownership and management of the railways and other industries will we secure the greatest efficiency in production, and the greatest equity in the division of what is produced? Upon this question there are the widest differences of opinion. With respect to the railways there are, on the one side, those who advocate private ownership and management, while, on the other side, there are those who advocate the Plumb plan. Whether supervising officers will decide that they ought to identify themselves with the managements of the railways as they have in the past, or associate themselves more or less with the employees in the disputes arising between the managements and the employees, doubtless will be determined largely by which system of railroad ownership and management they favor. It is not necessary for me to tell you that the railroad brotherhoods have made, and still are making, efforts to get supervising officers of all classes to aline themselves with the brotherhoods and adopt the ordinary union methods of dealing with the managements regarding their conditions

* From an address delivered at a meeting of the International Association of Railroad Supervisors of Mechanics, Milwaukee, Wis., September 22, 1920.

of employment and wages, and to support the Plumb plan of railroad ownership and management.

Importance of the Attitude of the Foremen

It is of great importance to the railway companies, and also to the supervising officers, that the supervising officers should decide wisely regarding the stand that they are going to take concerning the differences which arise between the railway managements and the employees. The managements of the railways cannot operate them efficiently under private ownership unless they can rely upon the supervising officers to carry out the policies of the managements thoroughly and to so direct the employees as to get the best practicable service from them. Let me ask you, therefore, to consider for a moment some of the arguments for the Plumb plan, and some of the arguments for a continuance of private ownership and management.

Under the Plumb plan, the public would buy the railways and guarantee their operating expenses and the interest on the money invested in them. Thus the public would assume all the risks of losses being incurred. The managing board of the railways would be composed one-third of representatives of the public, one-third of representatives of the officers, and one-third of representatives of the employees. This means that it would be composed two-thirds of employees, since under this system there would be practically no difference between officers and employees. A board composed entirely of officers and employees would fix all salaries and wages. If any surplus over interest on the investment in the railways were earned, the employees would get one-half of it. It is claimed that the adoption of this plan would establish industrial democracy on the railways, and would be beneficial to those employed by them and to the public.

Defects of the Plumb Plan

To my mind, the plan has one fatal defect. No business is ever well managed unless it is managed either by its owners or by persons selected and removable by them. The reason is, that in order that a business may be well managed it must be managed by or on behalf of persons who will not only gain if it is well managed, but lose if it is badly managed. Under this plan, all the risks of loss would be taken by the public and not by the employees, who would be in control of the management, while if any profits were made the public would get only one-half of them and the employees the other half.

But, the advocates of the Plumb plan answer, the employees are now opposed to private ownership and management because if any profits are made they go to the rich capitalists, who are alleged to own the railways, and the employees cannot any longer be expected to work efficiently to produce profits for the capitalists. As a matter of fact, this allegation that the owners of the railways get the bulk of the benefits of their operation under private ownership is not true. In 1917, the last full year of private operation, the employees received in wages about $1,750,000,000, while the net operating income of the railways, out of which all interest and dividends had to be paid, was about $1,000,000,000. Since then the wages of the employees have been advanced to $3,600,000,000, or over 100 per cent. Of this advance in their wages $625,000,000 has been given by the Railroad Wage Board since the railways were returned to private operation, thus showing that under private ownership and management the employees can get large advances in wages if they are entitled to them. If the advances in freight and passenger rates recently granted yield as large earnings as they are expected to, the net operating income of the railway companies will be made only a very little more than it was in 1917. In other words, although the employees have been granted increases in wages exceeding 100 per cent, the owners of the railways have been granted practically no increases at all in the net operating income from which their interest and dividends must be paid.

How Employees Could Control the Railroads

Furthermore, it is not necessary to adopt the Plumb plan, nor any other plan of government ownership, to enable the railway employees to come into control of the management of the railways. They could acquire control of the management by acquiring the ownership of a majority of the stock of the railroads. Now, it may occur to you that this would be a difficult thing for them to do, but, let us see. The total outstanding stock of the railways amounts to $6,580,000,000. The recent advances in the wages of the employees was $625,000,000 a year. By a very simple calculation you will find that by merely saving their recent advance in their wages and investing it in railway stocks, and also investing in stocks the dividends they would receive from them, the railway employees could buy a majority of the stock of every railroad in the United States at par in five years. But at the present time the stocks of the railways are not selling at par, or for $100 a share, but for an average of less than $60 a share. On the basis of the prices at which railway stocks are selling now, if the railway employees would save merely their recent advance in wages and invest it in railway stocks they would, in three years, own a majority of the stock of all the railways in the United States, which would give them absolute control of the management.

But it may be said that the employees will never do this, that they will not make the sacrifices necessary to save the money, and that while they are capable of forming powerful labor unions they are not capable of so organizing themselves as to use their financial power. But to make such arguments is equivalent to contending that the employees are not capable of managing the railways, because men who have not enough self-control to save a comparatively small part of their incomes, or enough brains to invest it wisely, have not the ability to manage the railways of the United States. If they have not the ability to manage the railways of the United States, then of course the adoption of the Plumb plan would be disastrous to the public and, in the long run, to the employees themselves.

Duties of the Railroad Officers

On the whole, it seems to me that the arguments against adopting the Plumb plan and continuing the present system of private ownership and management are overwhelmingly conclusive, since under the present system of private ownership and management the employees already have the power to acquire control of the ownership, and through it the management of the railways, if they have the character and brains to do it. But if the system of private ownership should be continued, then it seems to me the duty of every railway officer, high and low, and the duty of every employee is obvious. Their duty is, first, to put forth their best efforts to promote the most efficient possible operation of the railways, and, secondly, having done this also to exert themselves to get for themselves the working conditions and the compensation to which they are justly entitled. As to the supervising officers specifically, it seems to me their plain duty is, acting for the management, to treat the employees fairly but at the same time to spare no effort to cause every employee to give a fair day's work for a fair day's wage. What is a fair day's work? I have never opposed or criticised the establishment of the eight-hour day in industry, although I believe there are conditions under which it is desirable that a man should work more than eight hours. I began my working life as a printer and spent ten hours each day in work and my evenings in study, and I have had to work and study considerably more than an average of ten hours a day all my life because I had to educate myself. As for eight hours' work, it is as little as any man ought to do in a day, and if a man works only

eight hours he ought throughout the day to do the best and the most work of which he is capable. If all of us are to be supplied with the necessities, the comforts and the luxuries which are essential for human existence and happiness, the world's production must be increased and it cannot be increased sufficiently, at least under present conditions, to provide the necessities, comforts and luxuries for all of us unless we all work hard and well.

The Present Problems of the Railroads

At the present time, as you know, the railways are unable to transport all the commodities that this country can produce, and their inability to do so is limiting the amount of commodities that are being produced. Failure to increase the facilities and capacity of the railways would mean that there could not be any further increase of the production of coal for our industries or homes, grain from which to make our bread, and of lumber and other materials from which to construct additional business buildings and houses in which to live. Therefore, no matter how you view it, failure to maintain and increase the efficiency with which the railways are operated is bound to result in a national calamity from which we shall all be sufferers.

The immediate problem confronting the railways is that of handling all the traffic that is physically possible with the facilities they have at the least practicable expense, consistent with the present wages of labor and the present prices of material. Another problem none the less pressing which is confronting them is that of increasing the facilities so they may be able to handle more business than possibly can be handled with existing facilities.

I have no criticism whatever to make upon men having common interests who organize as you have to promote those interests, but such organizations should be made not obstacles but aids to furthering not only the interests of their members, but also the interests of the industries in which those composing them are employed, and also the interests of the public. It seems to me very plain, and I am sure it is plain to you, that it is to the interest of the railways, to the interest of the public and your own interest that you shall use all your influence and all your ability to increase in every way you can the efficiency of the operation of the railroads of the United States.

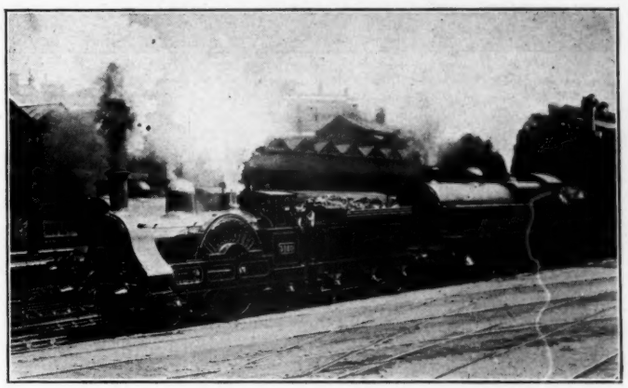
SEVENTY-THREE-YEAR-OLD LOCOMOTIVE IN SERVICE IN ENGLAND

BY E. C. POULTNEY,
M. Am. Soc. M. E., A. M. Inst. M. E.

Much interest has been caused recently by the reappearance of the famous London & North Western locomotive "Cornwall" in main line service. The photograph accompanying this article shows the engine "Cornwall," now 73 years old, assisting the "Patriot,"* one of the latest London & North Western 4-cylinder superheaters express locomotives of the "Claughton" class on the 1:15 P. M. Scotch Express from London. A description of the "Claughton" class express locomotives will be found in the *Railway Mechanical Engineer* for November, 1915. The following particulars and brief historical sketch of the locomotive "Cornwall" may be of interest:

The "Cornwall" was built during that period of English railway history known as "the Battle of the Gages," occasioned by the policy of the then Great Western directors, acting on the advice of their engineer Brunel, in adopting the 7-ft. gage as against the 4 ft. 8½-in. gage inaugurated by Stephenson and used on all other lines. Excellent records for speed having been claimed for the Great Western 8-ft. single driver express engines, Francis H. Trevithick, then the locomotive engineer of the London & North Western at Crewe, and a strong advocate of the narrow or 4 ft. 8½ in. gage, built, in 1847, the engine "Cornwall" having single driving wheels 8 ft. 6 in. in diameter, with the idea of showing that whatever could be done in the way of speed on the broad gage could be equally well done on the narrow. The engine was completed in November, 1847, and when first built the boiler was placed below the driving axle in order to obtain a low centre of gravity. Two steam domes were fitted to the original boiler, each joined together by an internal steam pipe taking steam to the "outside" cylinders, which were 17½ in. by 24 in. A safety valve was fitted to each dome.

It does not seem to be quite clear as to how many wheels the engine had when first built; some say eight were used—four in a group at the leading end, but not in the form of a "Truck" or "bogie," then the drivers and a single pair at the trailing end. Drawings of the engine thus equipped have several times appeared, but it is thought that such an arrangement was only proposed prompted by the fact that several Great Western engines of the period were so designed, and that in reality the engine always ran on six wheels as shown in the photograph. In 1858 the engine was rebuilt with a new boiler placed above the axle. Before being rebuilt the engine was shown at the London Exhibition of 1851. It is also reported to have attained a speed of 117 m.p.h. down a grade between Madeley and Stafford on the North Western main line. After being rebuilt a second time by the late F. W. Webb, the engine was stationed at Edgehill, near Liverpool, in 1890, and was principally used in running the 45-minute express trains between Liverpool and Manchester. The "Cornwall" was taken off the Liverpool and Manchester trains in 1902, and finally was taken out of service in August, 1905, being considered amongst those whose work is done. The engine was actually in work 58 years, and from the time it was rebuilt in November, 1858, to August, 1905, it ran 928,838 miles. No record of her mileage prior to 1858 is available.



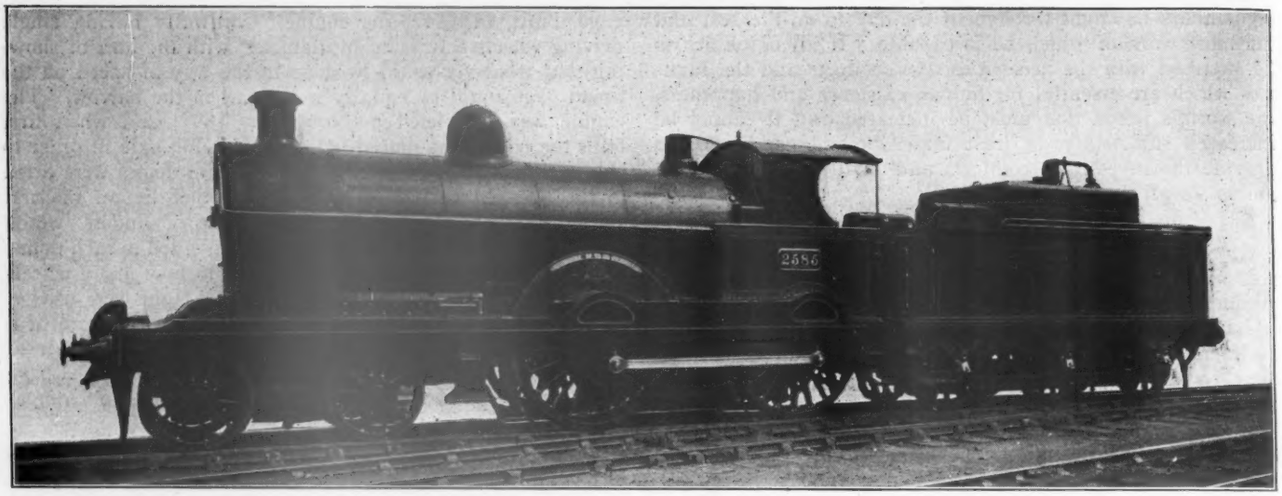
English Locomotive "Cornwall"

After being taken out of service the engine was used for the Chief Mechanical Engineer's private coach; the coach, which runs on six wheels, being arranged with a coal bunker at one end, was coupled direct to the engine, a tender being dispensed with.

The following are the leading dimensions of this interesting locomotive:

Heating surfaces:	
Tubes	981.0 sq. ft.
Firebox	87.3 sq. ft.
Total	1,068.3 sq. ft.
Grate area	15.0 sq. ft.
Weights in working order:	
Leading wheels	21,952 lb.
Driving wheels	28,000 lb.
Trailing wheels	13,440 lb.
Total	63,392 lb.
Diameter of driving wheels	8 ft. 6 in.
Size of cylinders	17½ in. by 24 in.
Steam pressure	140 lb.

*This locomotive was named "Patriot" in memory of the L. & N. W. employees who were killed in the war.

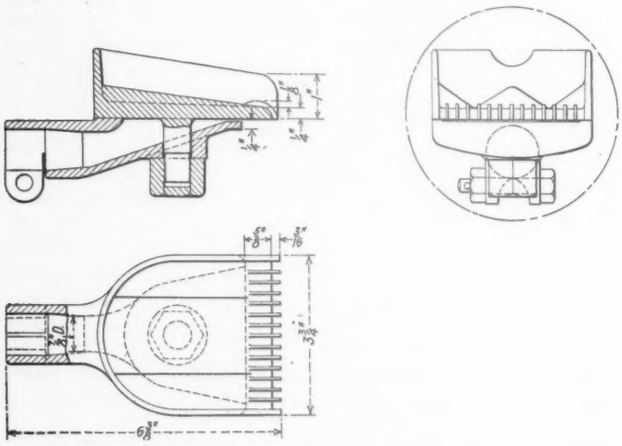


London and Northwestern Locomotive Equipped for Burning Oil

ENGLISH RAILWAYS EXPERIMENT WITH FUEL OIL

Description of the Scarab Fuel Oil Burning Apparatus Tested on the London and Northwestern

SEVERAL months ago the London and Northwestern equipped one of its locomotives for burning fuel oil in place of coal. The locomotive has since been operating successfully in various classes of service and if the object of this test is to determine whether the use of fuel oil would be successful from a service standpoint, the results have so far been eminently successful. The extension of fuel oil use to additional locomotives will, it is presumed, depend very largely upon the availability of this fuel in comparison with coal. The experiments were undertaken on the initiative of the London and Northwestern but the results, particularly from an economic standpoint, will be of importance to all English railways.

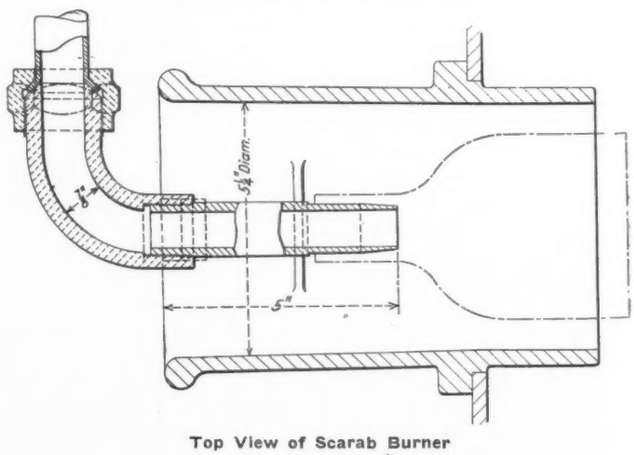


Details of Scarab Burner

Application of Oil Burning Equipment

The work of conversion to oil burning was carried out at the Bow Works of the London and North Western Railway Co. Certain of the parts were manufactured at the Crewe Works, while others were supplied by the Scarab Oil Burning Company of London. Immediately upon the completion of the work at Bow, the locomotive was steamed out under oil, and, after carrying out a series of preliminary runs and assisting main line trains, it was put into passenger service, first on a slow train to Bletchley, then on a medium fast train to Rugby, and finally on the London and Birmingham service.

The firebox of the locomotive is of the narrow deep type and presented considerable difficulties in the way of fitting a satisfactory oil burning system. The minimum permissible clearance between the bottom of the ashpan and the rails is such that no little ingenuity was necessary in order to fit a suitable oil burning ashpan with its necessary air ducts. To secure the maximum efficiency with liquid fuel, in a furnace, and obtain complete combustion without excess of air or the production of smoke it is necessary to provide a burner capable of thoroughly atomizing the oil without liability to stoppage on any account, and of performing this atomization with equal efficiency over a wide range of consumption. The interior of the furnace should be so fitted with firebrick that the atomized oil is completely consumed, and the flame so directed that the heat generated is applied most efficiently to the heating surface of the boiler. It is necessary, further, that the air supply and its



Top View of Scarab Burner

control be so arranged that only the requisite amount of air necessary to complete the combustion is admitted at such points that complete combustion is at once formed.

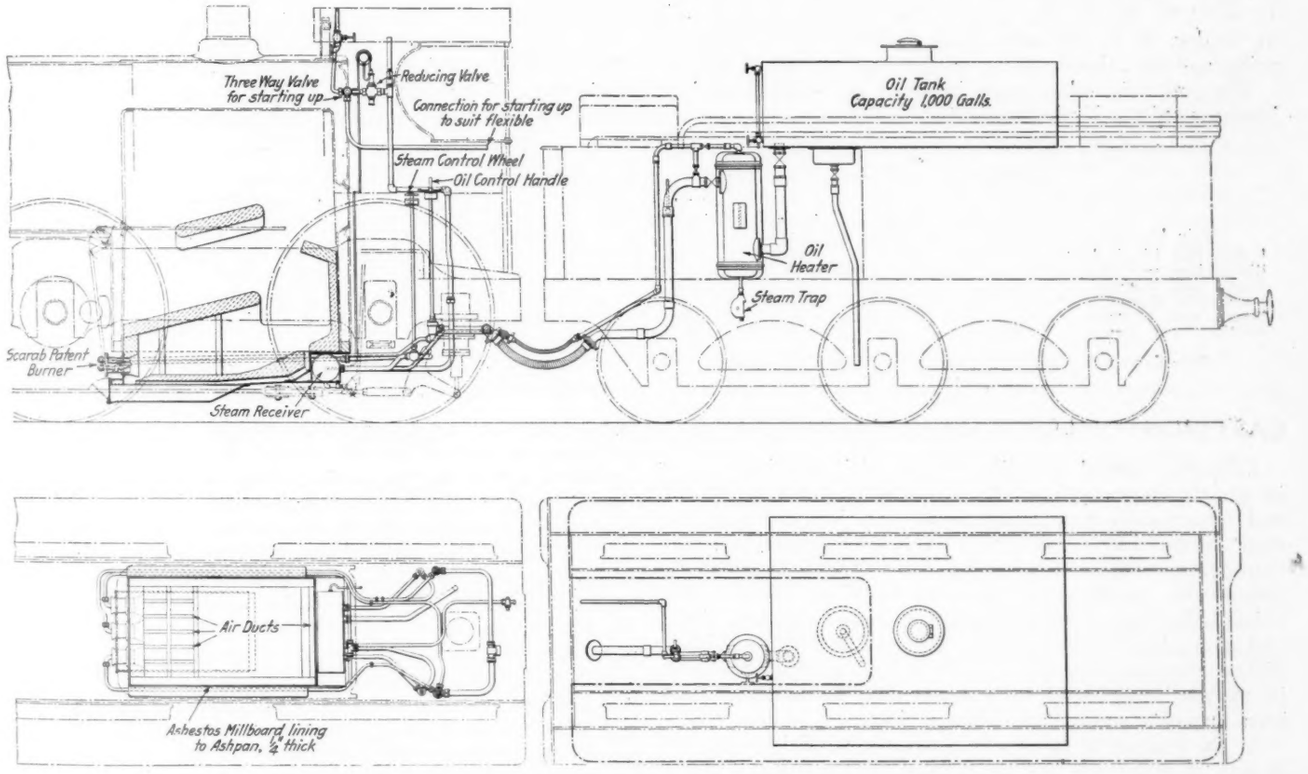
Description of Apparatus

The Scarab burner does not differ in principle or mode of operation from the type of oil burner ordinarily used in locomotive service in this country. The fuel oil is led by means of a pipe under control of a needle valve to the upper side of what may be termed an open-ended tray. The oil falls on to this tray and immediately spreads over the whole surface, eventually finding its way over the open end in the form a fine stream or ribbon. A number of small fins are arranged along the open edge, in order to ensure that the ribbon of oil passing over the edge is of even thickness from side to side. Immediately under the tray previously referred to, is a space to which the steam or air forming the atomizing agent is led by pipes under the control of a valve. The atomizing agent is supplied at a pressure up to 15 lb. per sq. inch for the maximum rate of burning, and is controlled down to about 5 lb. per sq. inch for the lowest rate of burning.

By reference to the general arrangement drawing herewith, it will be seen that the burners are placed in the smokebox end of a special ashpan below the foundation ring of the firebox. The flame is projected towards the rear end of the firebox, and thence deflected towards the tubeplate; in conformity with the almost universal practice in this country, three burners are installed, and they are so connected to the oil and steam supply that the center burner, the two outside burners, or all three burners can be used. However, after some preliminary runs were made, it was found that the best results were obtained with the center burner operating only, and this burner was accordingly provided with a nozzle capable of dealing with 160 gallons of oil per hour. The outside burners are now provided with nozzles of about 20 gallons per hour capacity, and are used as "pilot" burners for maintaining steam while the engine is standing.

Elaborate Brick Arch Arrangement

A low arch is provided immediately over the burners, in order that the heat of the first ignition of the oil spray may be concentrated, and complete combustion effected as soon as possible. A small arch before the coal fire door serves to deflect the rush of flame from this door and the arch across the center of the firebox directs the flame all over the fire box surfaces and obviates a short circuit to the boiler tubes. A certain quantity of air is admitted through the burner casings themselves. This air is not under control, and simply provides the oxygen necessary for the initial combustion of the oil spray. Additional air enters through a damper placed below the firebox, and it is heated by its contact with the hot surfaces of the ashpan exposed to the flame. A considerable proportion of air travels to the burner by a passage provided immediately underneath the nozzle:



Arrangement of Oil Burning Apparatus Applied to English Locomotive

a further portion enters the furnace through a number of small holes in the firebrick false bottom of the ashpan, a few feet in front of the burner nozzle. The remainder of this air supply is allowed to pass into the furnace close to the back plate of the firebox, and, having been highly heated on its way, it is admitted to the furnace so as to provide the necessary oxygen to complete the combustion of the already ignited oil spray.

The steam for atomization is taken from the top of the boiler to a reducing valve set to deliver steam at 15 lb. pressure, which is conveyed to a receiver placed longitudinally in a space provided at the back of the ashpan. A safety valve is provided on the low pressure side of the pipe line. From the receiver, steam is conveyed by pipe lines to the burners through regulating valves operated from the cab. A connection for starting up the engine from cold by means of an auxiliary supply of air or steam is fitted in the

cab. This connection is also fitted with a pipe leading from the blower ring in the smoke-box for creating a draught when starting up. Low pressure steam is taken from the receiver back to the oil heater on the tender, also to the oil pipe line leading to the engine, suitable valves being fitted so that all oil in the pipe line may be blown out into the ashpan at the end of the day's run. This ensures that the oil pipes will be clear for starting up when required. From the main oil tank the oil flows by gravity through a specially designed heater. A thermometer is provided on the oil pipe line immediately after the heater to register the temperature of the oil. To prevent waste of steam through the heater, a steam trap is provided.

Results of Tests

Test runs which have been made with this locomotive indictate an average oil consumption of under 30 lb. per mile as compared with the coal consumption of 70 lb. per mile of this locomotive when it formerly used coal as fuel. The oil which has generally been used was of a very dark brown color and asphaltic in odor. The specific gravity at 60 deg. F. is 0.907, the flashing point is 180 deg. F., the viscosity at 70 deg. F. is 290 secs. The distillate is free from tar acids, and the calorific power is equivalent to 19,366 B.t.u.

The following table shows in detail the results that have been secured on this locomotive with oil fuel.

RESULTS WITH OIL FIRED LOCOMOTIVES ON LONDON AND NORTHWESTERN

Trip between	Distance Miles	Average speed	Weight of train Tons	Time standing	Oil used running Gals.	Oil used standing Gals.	Total oil used Gals.	Oil used per 100 ton mile Lb.
Euston and Birmingham	113	46.5	294	Birmingham—2 hr. 54 min.	402	68	530*	10.88
Birmingham and Euston	113	46	264	.....	357	..	377*	9.25
Euston and Rugby	84¾	31.4	247	Rugby—55 min.	304	22	386*	14.18
Rugby and Euston	84¾	31.4	221	.....	284	..	304*	12.3
Euston and Bletchley	46¾	25.5	203	Bletchley—1 hr.	220	38	318*	21
Bletchley and Euston	46¾	26.7	285	.....	160	..	180*	11

* These figures represent the total oil used from lighting up to return to the terminal.

CAST IRON FOR LOCOMOTIVE CYLINDER PARTS

Frequent renewal of cylinder parts of locomotives results in greatly increased cost of maintenance to the railroads, and consequently the quality of the cast iron entering into their construction is a matter of paramount importance, particularly from the standpoint of wear. These parts include piston-valve bushings, piston-valve packing rings, piston-valve bull rings, cylinder bushings, piston packing rings, and piston-head or bull rings. It was found that ordinary high-silicon cast iron gave unsatisfactory wear, particularly in modern superheater locomotives, and the tendency has been toward a harder and stronger iron.

At the request of the U. S. Railroad Administration the Bureau of Standards has investigated the mechanical, chemical and microscopical properties of a number of packing rings furnished with service-mileage records, as well as arbitration-test bars, chill-test specimens, and miscellaneous samples from different manufacturers. All of this material was cast iron such as is used for the various cylinder parts. At the same time a review was made of the previous work and specifications on this subject, to ascertain as far as possible the practices of the different foundries and to suggest such revision of existing specifications as would be warranted by the results of the present and of earlier investigations.

The results of the tests are to be published in Technologic Paper No. 172 of the Bureau of Standards, by C. H. Strand, associate physicist.

Conclusions are drawn and recommendations made as follows:

1. On the basis of tests made by inspectors of the U. S. Railroad Administration and this bureau, which were substantially in agreement, it is concluded that air furnace or so-called "gun iron" is more uniform in character and on the average of somewhat better mechanical properties than cupola iron. The latter, however, often equals or even excels in mechanical properties the specimens of air-furnace iron tested in this investigation. The sulphur content of the air-furnace irons examined seldom exceed 0.06 per cent, while the cupola irons varied in sulphur content from 0.10 to 0.17 per cent.

2. The findings of the American Railway Master Mechanics' Association with respect to correlation of laboratory and service tests are confirmed in the present investigation. It was impossible, except in a very general way, to find any correlation between the quality of the iron as developed by laboratory tests and the mileage obtained in service. This is explained by the fact that many other factors besides the quality of the iron enter into consideration in the service results, namely, design, lubrication, method of handling the locomotive, topography of the country, character of water used in locomotive, etc. The ring from foundry B, which gave the exceptionally good service of 93,000 miles, showed no unusual properties in laboratory tests. It is for the reasons cited above that the conclusions and recommendations of this paper are based essentially upon laboratory tests.

3. The present specifications of the American Railway Master Mechanics' Association are somewhat lax in the requirements for mechanical properties. It is recommended that the transverse strength requirements of the 1¼-inch arbitration bar be increased from 3,200 to 3,500 lb. for castings one-half of an inch or less in thickness, and from 3,500 to 3,800 lb. for castings over one-half of an inch in thickness. It is further recommended that the minimum deflection requirements for both cases be increased from 0.09 to 0.11 inch. The division line of the casting thickness is changed from five-eighths of an inch of the American Railway Master Mechanics' Association, to one-half of an inch in order to conform to the recognized standards of the American Society for Testing Materials.

4. It is preferable to leave the chemical composition and the melting process used to the manufacturer, depending for the most part on the mechanical tests, and of these primarily upon the transverse test. The existing specifications allow a maximum of 0.70 per cent phosphorus and 0.12 per cent sulphur; there are no developments in this investigation which would warrant a revision of the maximum permissible amounts of these elements.

Acknowledgment is given to Capt. S. N. Petrenko and T. W. Greene for the mechanical tests and also to S. Epstein for the metallographic work. The co-operation of the chemistry division of the Bureau of Standards in making the chemical analyses is likewise acknowledged.

The paper also includes a proposed specification for cast iron cylinder parts.

Equipment Orders in the First Nine Months of 1920.—The Class I railroads of the United States ordered in the first nine months of 1920, 1,403 locomotives, 40,254 freight cars and 814 passenger cars. Canadian roads ordered 154 locomotives, 10,773 freight cars and 174 passenger cars. The total orders for freight cars placed in the United States amounted to 57,172; in addition to the 40,254 placed by Class I roads, there were also 256 cars ordered by other roads and 16,662 by private car lines and industrials.

URANIUM AS A STRUCTURAL STEEL ALLOY

Characteristics Apparently Suitable for a Wide Range of Application to Locomotive Parts

BY HUGH S. FOOTE

Metallurgist, Standard Chemical Company, Pittsburgh, Pa.

DURING the past decade the volume of alloy steel production has been quadrupled and the automotive and aircraft industries have made wonderful strides in development. The progress of these industries is very intimately connected with the betterment of alloy steels. With the development of alloy steels of greater strength, of improved capacity to sustain sudden loads, and with a greater resistance to vibration and wear, more weight may be eliminated, thus contributing to greater commercial economy in many ways. A steel possessing such capabilities should also have the following qualifications: A competitive cost price; simplicity in heat treating processes, and simple composition. The greater the number of alloys present in the steel, the more independent variables there are to influence its properties; while the fewer the alloys, the more simplified is the steel practice, the greater the purchasing efficiency, and the less inspection and routine chemical analysis.

The development of uranium steel has produced a type which promises to fulfill these requirements. In addition, uranium steels are not embrittled by high temperatures, nor do they show a tendency to crack under severe quenching; and because of the depth hardening effect of uranium, they are less liable to warp in heat treatment. This means economy through less regulation and fewer rejections of the steel.

The Influence of Uranium

To date, the industrial application of uranium has been confined to high speed tool steel. The evidence would seem to indicate that uranium promotes the formation of a complex carbide which is more readily soluble in gamma iron than the usual carbide of high speed tool steel. Since the cutting property of this type of steel is dependent upon the dissolved carbides, the function of uranium is in part to increase the cutting qualities. Inasmuch as uranium also belongs to the same group or family as tungsten, it may be assumed logically that uraninum also tends to increase the red-hardness.

The experimental work on the application of uranium to carbon and simple alloy steels has been carried on for four years. Uranium is one of the most powerful elements yet discovered for alloying with steel, and the most active in making steel respond to heat treatment. Microscopic examination shows that the uranium in structural steel probably combines with the cementite to form a double carbide of iron and uranium. It emphasizes the characteristics of the cementite to a greater degree than other carbide forming alloys and is effective with a lesser loss of ductility and in a wider range of temperature limits in its heat treatment than other alloys.

Dr. George K. Burgess, of the Bureau of Standards, states that unlike zirconium and titanium, uranium appears to enter into solution in steel, that is, it is a true alloying addition. In the normalized specimens a distinct martensitic and troostitic pattern is present, which is undoubtedly due to the presence of the uranium in solid solution, as otherwise the structure would be found to consist of granular pearlite and ferrite.

The introduction of uranium into steel in amounts over .60 per cent imparts no properties which are not obtainable with a lower percentage contents. This is illustrated by the following analyses:

Chemical composition, per cent,		Elastic limit, lb.	Tensile strength, lb.	El. in 2 in., per cent	Red. area, per cent	Brinell
Carbon	Uranium					
.46	3.02	85,700	125,200	18	41.6	241
.45	1.40	81,900	116,700	21.5	54.2	231
.44	.19	97,500	144,030	17.0	61.8	293

Heat treatment in each case: 1,500 deg. F., quenched in oil and drawn to 570 deg. F.

Uranium is not limited by carbon content for its effects. This is illustrated by an example in which the addition of .56 per cent uranium to a .19 per cent carbon steel gave an elastic limit of 110,000 lb., a tensile strength of 140,700 lb., with an elongation in two inches of 11.5 per cent, a reduction of area of 52 per cent and a Brinell hardness of 235, when quenched in water from 1,560 deg. F., and drawn back to 480 deg. F. Furthermore, uranium does not need the effect of an intensifier, such as is produced by chromium when used with nickel or vanadium to bring out its full influence. This point is illustrated by the comparison shown in the accompanying table.

COMPARISON OF CHROME-VANADIUM, CHROME-NICKEL AND CARBON-URANIUM STEELS OF MEDIUM CARBON CONTENTS

Chemical Composition

"A"—C, .54 per cent; U, .27 per cent; Mn, .61 per cent.
"B"—C, .50 per cent; Cr, 1.06 per cent; V, .20 per cent.
"C"—C, .50 per cent; Cr, 1.10 per cent; Ni, 1.75 per cent; Mn, .45 per cent.

Physical Properties

	Elastic limit, lb.	Tensile strength, lb.	El. in 2 in., per cent	Red. area, per cent	Brinell	Merit number
"A"....	226,000	248,800	10.0	35.4	477	2,488,000
"B"....	217,300	227,000	10.0	35.5	402	2,270,000
"C"....	200,000	215,000	8.0	35.0	400	1,720,000

Comparative static and dynamic tests were made between the usual bearing steel and uranium steel. The bearing steel contained 1.01 per cent carbon, 1.68 per cent chromium, .18 per cent vanadium and .34 manganese, while the uranium steel had a carbon content of .63 per cent, .40 per cent uranium and .50 per cent manganese. Comparisons of dynamic and static tests of these steels after being hardened and drawn back through a considerable range of temperatures are shown in one of the tables. Comparing the tension tests

STATIC AND DYNAMIC TESTS OF URANIUM AND CHROME-VANADIUM STEELS

Uranium Steel

Elastic limit, lb.	Tensile strength, lb.	El. in 2 in., per cent	Red. area, per cent	Brinell	Heat treatment	
282,700	322,400	6.0	14.5	600	Quenched from 1,480 deg. F. drawn to	480 deg. F.
267,100	287,400	8.0	20.6	555		570 deg. F.
230,000	256,800	8.5	23.4	495		660 deg. F.
224,600	237,100	9.0	25.1	477		780 deg. F.
180,900	202,700	11.5	33.8	418		840 deg. F.
Charpy impact = 87 ft. lb. per sq. in.....						750 deg. F.
Alternating impact = 538 and 456 blows.....						750 deg. F.

High Carbon Chrome-Vanadium Steel

Elastic limit, lb.	Tensile strength, lb.	El. in 2 in., per cent	Red. area, per cent	Brinell	Heat treatment	
Broke at 271,440		...	...	600	Quenched from 1,500 deg.F. in oil, drawn to	480 deg. F.
265,850	285,220	2.5	4.2	555		660 deg. F.
217,900	234,140	4.0	10.7	477		750 deg. F.
203,090	217,320	7.0	20.9	444		840 deg. F.
163,500	172,840	11.5	30.8	364		1,020 deg. F.
Charpy impact = 53 ft. per sq. in.....						750 deg. F.
Alternating impact = 498 and 412 blows.....						750 deg. F.

either on the basis of Brinell hardness or on that of static strength, it is seen that the superiority lies with uranium steel. The ductility of the uranium steel, particularly at the lower drawing temperatures, is remarkable. This property is utilized in obtaining the merit number by multiplying the tensile strength of the material by its elongation, thus giving a relative idea of the amount of work that must be expended upon the material to break it. In other words, its strength must be overcome through a distance represented by its ductility before it may be broken. The dynamic tests show that the uranium steel possesses a greater resistance to shock and vibratory stresses conducive to fatigue than does the high carbon chrome steel.

Heat Treatment

The heat treatment of steel is one of the most important operations to which it is subjected, and to obtain the highest physical properties by this means, it is necessary to have accurate knowledge of the critical or transformation points. Although the changes due to heat treatment are governed by definite laws, the same treatment cannot be applied to all steels with satisfactory results, for each type of steel responds best to its own characteristic temperature.

Up to a content of two per cent, uranium has no marked influence on the critical or transformation temperatures. The majority of determinations place the Ac_1 (decalescent) point in the interval of 1,365 deg. F. to 1,380 deg. F. and in steels with a uranium content under two per cent the beginning of the Ar_1 (recalescent) point is between 1,255 deg. F. and 1,275 deg. F. Leeds & Northrup, in carbon steels (carbon .20 per cent to .60 per cent) place the Ac^1 point at 1,367 deg. F. and the Ar_1 point between 1,275 deg. F. and 1,259 deg. F.

The quenching temperatures of uranium steels do not differ radically from those of carbon steels. In general, the heating for hardening should be slow, uniform, thorough and to the lowest temperature which will give the desired results. Contrary to the characteristics of most alloy steels of a carbide nature, those containing uranium are not inherently sensitive to prolonged heating or severe quenching.

In order to obtain the superior dynamic qualities and at the same time avoid the large grain size caused by the high temperature annealing it has been our practice to normalize uranium steels. The forged or rolled material is slowly and thoroughly heated from 1,650 deg. F. to 1,700 deg. F., cooled in the air until black, then annealed at a temperature which will give the desired softness or physical properties. The normalizing accomplishes the following purposes: First, the high temperature overcomes any sluggishness on the part of the uranium toward going into solid solution. Second, all strains caused by previous operations are eradicated while the crystalline structure is refined, and third, the steel is in the best possible condition for heat treatment.

The function of the quenching medium is to remove the heat from properly heated steel with sufficient rapidity to enable it to retain the martensitic constituent. In this connection it may be said of uranium steels that they do not give a tendency to crack when quenched in water as do steels alloyed with chromium.

FOURTEEN POINTS OF INDUSTRIAL RELATIONS

In a recent article in the Iron Trade Review, Robert E. Newcomb, of the Worthington Pump & Machinery Corporation, set forth the disadvantages of employee representation in the management of industry. Mr. Newcomb stated that the soviet form of control would probably not be a permanent success and offered as a solution of the industrial problem the following basis for relations between employer and employee:

1. The policy of directors and managers must be one of human interest in the welfare of the employee for the good it does the man.

2. Educate present foremen to the policy of the management by frequent individual conferences, as well as group conferences with the foremen. This is frequently neglected but of great importance, as the foreman is the key to the industrial situation and frequently unintentionally throws sand into the wheels of industrial harmony.

3. Use greater care in the selection of executives, especially the foremen, taking only those of high moral character and of broad human interest and train them to share responsibilities with employee and management.

4. Train an employee thoroughly with respect to his trade and in an unselfish way, thus fitting him for promotion and inspiring him with an intent to rise above his existing condition by his conscientious efforts and industry.

5. Scientifically organize and control the management of the establishment. Rule it with a firm, efficient, economic and just power, and human love.

6. Establish a wage system which will appeal to the individual and inspire him to his best efforts.

7. Encourage executives, and especially foremen, to have a friendly interest in the personal affairs of the employees.

8. Be prepared to advise an employee with reference to legal matters, medical attention, how and when to borrow money for building purposes, how and where to invest money in safe conservative investments.

9. Where the corporation is large enough, legal and medical advice and investments and loans should be handled by experts. In other cases the employment officer and the superintendent should know to what lawyers and doctors and banks to direct their employees to get the necessary advice.

10. Help the employee to acquire a home by making such arrangements with the bank as will enable him to procure funds. The company can usually take out a second mortgage which the bank will carry with the company's endorsement at no expense and small risk to the company. The home owner acquires a proprietary interest in his property and naturally acquires the instinct of a property owner.

11. For those single men and others who do not wish to acquire a home, provide means for investing surplus funds, such as conveniences for making deposits in the savings bank at the rate of so much per week, a method corresponding to the deductions for the Liberty loan.

12. Also provide some scheme whereby the employee can purchase stock in the corporation, weekly payments being taken from his wages.

13. Encourage sick and accident insurance, and if possible provide old age pensions. These should be provided by state legislation, but may be advantageously handled through private companies until such legislation is passed. These advantages should not be provided entirely free of cost to the employee, but may be provided in part by the corporation for the purpose of encouraging the employee to look out for the future.

14. Avoid anything and everything which has an indication of paternalism or charity. Executives should be democratic and take pains to recognize employees on the street and in all public places. Do not have or permit the executives to have too much official dignity; insist, however, that they maintain natural dignity.

Fuel Saving in France.—Following a vote of the Paris Municipality, the Prefect of the Seine Department has opened a competition, for which 100,000 francs have been set apart for distribution in prizes, with a view to arriving at practical means for attenuating the fuel crisis. The competition is to bear on the apparatus, products, or processes which can come into use either from the commencement of next winter or at a later date. When the competitors have been classified by the deciding jury, an exhibition is to be held of the schemes which are likely to give immediate results.—*L'Electricien.*

THE MECHANICAL STOKER AND FUEL ECONOMY

Analysis of Some Conditions Obtaining in the Locomotive Firebox Provided with Stoker Operation

BY F. P. ROESCH
Standard Stoker Company

THERE is no question that the ever rising cost of coal, together with the presumably increased amount necessary to produce a gross ton mile, when comparing hand with stoker firing, has a material influence on stoker applications, not only on new, but to existing power on which the application might be warranted, in order to obtain the full potential power output from the locomotive in question.

Past experience, as well as repeated tests, have amply demonstrated that this opinion, apparently well founded, cannot be gainsaid. It is equally true, however, that the conditions surrounding the various experiences and tests have not been fully considered in all their phases.

It would appear that the mechanical stoker is not being applied through any intrinsic worth or capacity increasing possibilities essentially its own, but because either the new locomotives are becoming so large as to preclude the possibility of successful hand firing when worked to their capacity, or to the fact that the class of labor from which we formerly drew our enginemen is seeking occupation in fields where the work is less arduous.

In discussing stoker possibilities, the following are the arguments generally used against their application:

First—The engines do not steam as well when stoker fired.

Second—Stokers increase the delay at cinder pits, owing to their tendency to clinker fires.

Third—They increase the cost of maintenance per locomotive mile.

Fourth—They burn more coal per 1,000 ton-miles than the same locomotive hand fired.

I believe an impartial analysis of the foregoing objections will prove that none present well founded objections or impose conditions that cannot be overcome.

Stokers Not Responsible for Non-Steaming or Clinkering

The function of the modern stoker is to prepare the coal, (i. e., crush it to firing size), convey it to the firebox and distribute it over the grate surface. As all stokers handling mine run coal perform the first and second operations automatically, the steaming of the locomotive can only be effected by that part of the operation depending upon the fireman, namely, the amount of coal supplied to the firebox and its distribution. As the amount can be varied to suit the requirements, and as the modern stoker has a flexibility of distribution equal to that possible with the most expert scoop manipulation, it follows that if given the same attention as to quantity of fuel supplied and distribution over the grates, the introduction of fuel manually or mechanically should in no manner affect the steam generation.

How then can we consistently attribute the non-steaming of any locomotive to the stoker? Any analysis of such a charge will invariably point to the human agent, the physical condition of the locomotive or the characteristics of the fuel. And yet the writer knows of many instances, notably some where the stacks of a recent consignment of locomotives were from 1 to 3½ inches out of line with the exhaust nozzle, and where the failure of the locomotives to steam freely was attributed solely to the mechanical stoker.

Clinkers are formed by the fusion of iron pyrites, sulphur, etc., at low temperatures. It follows, therefore, that clinkers are primarily a characteristic of the fuel, aided in their formation, of course, by the manner in which it is handled. The charge has been made that clinker formation is aggravated by the introduction of steam jets over the fire. On the contrary, it has been proven that the moderate use of small steam jets are beneficial, as they are a material aid in the thorough mixing of the gases distilled from the fuel, a prime essential in perfect combustion.

Stoker Maintenance and Fuel Consumption

There is no question but that the application of any auxiliary appliance to any locomotive will increase the cost of maintenance. This applies with equal force to the air brake, the lubricator or any other adjunct, if the cost is simply based on the cost per locomotive mile; however, if the cost is based on the true barometer of locomotive operation, viz., *cost per ton mile per hour,* not only the stoker, but practically many other appliances can show a clean bill of health. The inconsistency of present methods of compiling statistics relating to locomotive performance was very forcibly brought out by Robert Quayle, of the C. & N. W., at the recent convention of the International Railway Fuel Association.

The fuel consumption of any locomotive depends altogether on the following factors: *First,* the characteristics of the fuel (i. e., the proportion of combustible to non-combustible or ash). *Second,* the condition of the boiler and its capacity to transfer heat. *Third,* the condition of the locomotive engine, insofar as economical steam utilization is concerned. *Fourth,* the service in which the locomotive is engaged, and last, but not least, the men in charge, or the manner in which the locomotive is handled and fired.

With all of the above factors equal, the only added increase in fuel consumption that can be attributed to the stoker is the additional weight to be hauled—each extra pound of weight requires a proportionate power output, regardless of whether the added weight is on or behind the locomotive—the steam necessary to crush, convey and distribute the fuel, the increase in spark losses and the losses due to improper combustion. The amount of fuel required to haul the stoker can be readily determined from the daily performance sheets, as, for instance, if this data shows a consumption of, say, 210 lbs. of coal per 1,000 ton-miles, then the weight of the stoker, multiplied by the coal consumption per mile, will give the coal chargeable to this item.

The fuel required to operate the stoker must, of course, be determined from the steam consumption. This by test for the engine and calculation for the distributor consumption, has been found to vary from 0.5 per cent to 2 per cent of the steam generated by the boiler, the difference depending on the type of stoker used. (See report of Pennsylvania Railway tests in the *Railway Mechanical Engineer* of April, 1920, page 199.) This factor holds good under practically all conditions, as where a greater demand is made on the boiler, a correspondingly increased demand is made on the stoker, and vice versa.

Spark Losses Due to Mechanical Stokers

That under some conditions there should be an increased spark loss with stoker fired locomotives is clearly evident when we consider the fact that spark losses are almost directly proportionate to the amount of slack contained in the coal and the height at which it is introduced into the furnace. As with the modern stoker, the coal is all passed through a crusher

before it enters the firebox, it follows that the slack must necessarily be increased over that obtaining with hand firing when the large lumps are simply cracked with the coal pick, if they are broken at all. While the slack content is a vital factor, yet the height at which the fuel is introduced is even more so, tests having shown that with the older type of stoker having a distributor located above the fire-door, the spark losses were reduced 30 per cent by cutting out or blanking this opening.

The spark loss, however, can be materially reduced, and with some types of stoker, practically eliminated, by simply increasing the length of the brick arch. Such an increase will not only reduce the spark loss, but improve the combustion, increase the firebox temperature, reduce the tendency toward stopped up tubes, increase the superheat, etc. True, there have been objections urged against the long arch, but principally by the firemen, on the ground that a long arch made the engines too hot at the door. However, with the application of the stoker, this objection loses its weight, as the fireman is no longer exposed to the furnace heat, and it might be well to note that as a long arch increases the heat at the door, it must follow that it increases the heat at the door sheet, thereby increasing the furnace efficiency.

Combustion in the locomotive firebox depends first upon the presence of the correct amount of air, and second on the thorough mixture of the air with the distilled gases. In the locomotive firebox the air is usually admitted through the grates and the fuel bed. Given a coal running high in non-combustibles, or an imperfect distribution of fuel, the admission of air becomes a very uncertain and in a measure uncontrollable quantity.

As a matter of fact, we know but little of what actually takes place in the locomotive firebox under the varying conditions of service. Our draft gages can only be inserted to a limited distance, hence can only register a local condition (i. e., the vacuum obtaining in the immediate vicinity of the opening). On the data so obtained we base our theories as to what is going on in other parts of the firebox. Aviators have found what they term "air pockets" or strata of air of lesser density than the surrounding atmosphere. Is it not reasonable, therefore, to assume that if such differences in pressure can occur in a practically undisturbed medium as compared with firebox conditions, that we have disturbances, air pockets and high and low pressures in the firebox likewise? And further, granting this hypothesis, does it not follow that these conditions vitally affect the efficiency of combustion?

Air Supply a Vital Factor

Tests conducted by the Bureau of Standards clearly demonstrate that where the air was introduced through the fuel bed alone, there was practically no free oxygen at a point three inches above the incandescent coals, indicating beyond the question of a doubt that the amount of air so admitted was insufficient. Again, many can bear witness to the fact that it is frequently necessary to hold the firedoor partly open, and with some coals, entirely so, to make up for the deficiency. With a locomotive hand fired, the needed amount is passed in through the opened door, not very efficiently, perhaps, but introduced nevertheless. In stoker firing the door is only opened when the fireman wants to observe the condition of the fire; consequently, practically all air must be introduced elsewhere. Where no other provision is made, the only point of entrance is through the grates and fuel bed; therefore, if the distribution is not uniform or the fuel bed is too thick, imperfect combustion and the attendant fuel loss is bound to ensue.

The necessity for an increased supply of air was fully recognized by F. F. Gaines and others years ago, when efforts were made to introduce the hollow arch on hand fired locomotives. If that was the case at that time and with that type of power, surely the necessity is doubly emphasized with modern power stoker fired. Therefore, is this not a vital point to be considered both by stoker manufacturers and railway mechanical men? Prof. Endsley echoed the thought at the 1920 convention of A. R. A., Section III, Mechanical, when he recommended the introduction of additional air in finely divided streamlets. His argument is too sound to warrant any effort at contradiction.

In the discussion of a report on mechanical locomotive stokers, the consensus of opinions expressed, as well as the results obtained at the Altoona testing plant, indicated that under moderate rates of combustion, hand firing was more economical than stoker firing, but at higher rates the stoker gradually approached expert hand firing in efficiency. The answer can be found in the preceding paragraphs, but to save reperusal, we can say, at moderate rates the fireman has ample time to so scatter the coal as to maintain a practically level fuel bed, and, as the time between fires is more infrequent, a lesser amount of air is introduced through the fire-door; while at the higher rates the continued opening of the door admits too much cold air, thereby retarding combustion, and the haste at which it is necessary to introduce the coal precludes effective scattering. If, however, with the stoker the same uniform spreading of the coal had been possible as with hand firing, and some provision had been made to introduce the additional air required above the fire, there is no question but that at the lowest rate the fuel consumption would be practically the same in both instances with no showing in favor of hand firing.

The entire subject is worth the careful study of all who are concerned in reducing the cost of locomotive operation, as with the ever increasing cost of fuel, no item that will in any way reduce the amount required per 1,000 ton-miles per hour is negligible. The stoker is here to stay, and its use will gradually be extended. Locomotives will continue to be operated from light to maximum capacity. The same amount of coal can be made to produce the same unit of work under proper conditions, regardless of whether it is placed in the firebox manually or mechanically.

Freight Car Production—Eight Months' Figures.—Figures of production reported by 23 leading car building companies associated with the Railway Car Manufacturers' Association show that the car building industry in August was working at a slightly higher percentage of capacity than in July. The number of new freight cars delivered in August totaled 3,056 for domestic service and 1,184 for export, as compared with 2,583 and 380, respectively, in July. The deliveries of passenger cars totaled 21 for domestic service and 13 for export. Car repairs totaled 2,818, as against 2,491 in July. At the end of August there were 49,442 freight cars for domestic service on order and undelivered, 861 passenger cars and 27,031 heavy repairs.

Cost of Railroad Fuel.—The increase in the cost of coal purchased by railways, in July, 1920, as compared with the cost in July, 1919, is shown in a compilation made by the Interstate Commerce Commission from reports received from 159 railroads. In July, 1920, these railroads purchased 9,627,491 net tons of bituminous contract coal at an average price at the mines of $3.24 per net ton, as compared with 8,880,021 net tons in July, 1919, at an average cost of $2.47. They also purchased 1,518,444 tons of spot coal at an average price of $6.01, as compared with 476,758 tons last July at an average of $2.40, an average of $3.58 for contract coal, as compared with $2.42 last year, and $8.36 for spot coal as compared with $2.51, while industries paid $4.40 for contract coal and $8.44 for spot coal, as compared with $2.13 and $2.04 last year. For anthracite coal the railroads paid an average of $4.23 for contract coal and $4.50 for spot coal, as compared with $3.45 and $3.04 last year. In the New England district the average was $7.14 for contract coal and $10.54 for spot coal as compared with $5.46 and $5.33 last year. The utilities paid $4.61 and $6.28 as compared with $3.19 and $5.15 last year, and the industries $2.48 and $4.85 as compared with $2.76 and $3.25.

BEST METHOD OF HANDLING FREIGHT TRAINS*

In order to handle freight trains efficiently and economically, it will be necessary to take into consideration the locomotive which hauls the train, as well as all other equipment used in doing the work; the locomotive must be put in the best possible condition before leaving the shop, so that it can handle the train efficiently and economically. With the eight-hour day and time and half time for overtime, the locomotive must haul the allotted tonnage over the division in as short a time as possible. This cannot be done with a 50 per cent engine.

CONDITION OF CARS

Cars should be in good condition before being sent out in a train to avoid delays due to accidents on the road. In order to do this, cars should be properly inspected and repairs made, or the cars switched out. It is necessary to have receiving yards laid out so that the work can be done quickly, and facilities should be provided to take care of all the details of inspection at one time.

All trains when stopped in receiving yards should have couplers stretched from engine to caboose; this can be done by having some hand brakes set on the rear of the train and have the engine pull the slack out. It is better to delay a train in the yard for inspection and repairs than it is to have it delayed out on the road. While in the yard only one track is blocked and other trains can pass on some other track, but on the road, when stopped by an accident, other following and opposing trains, in charge of crews making overtime, are blocked. When a train is delayed in the yard there is no crew time to be considered.

The same can be said of hot boxes. With the long and heavy trains that are being handled today, when you have to set out a hot box about 75 or 90 cars from the engine, it takes time and very often results in damage to other cars in the train.

All trains when stopped in the yards before the engine is cut loose should have the air brakes applied with a full service application, so that the air inspectors can go over the train and mark up the piston travel and defective brakes or brakes that are cut out, so that cars can be given the proper attention before being sent out of the dispatching yard. If the defect is such that the car must be shopped, it can be switched out while switching the train and then it will not have to be done after the train is made up, which very often delays the crew at the start of the trip and causes overtime.

All despatching yards should be provided with a yard air brake testing plant, and as soon as the train is switched the air should be coupled up from the yard plant and brake pipe leakage taken up, piston travel adjusted and retaining valves tested.

When the train and engine crews arrive, all that they will have to do is to couple the engine to the train and charge the brake pipe to the maximum pressure carried and test to comply with the rules in effect on the road. It has been found when trains have been worked properly by air men, all that is necessary for the crew to do is to know that the brakes will apply and release at the front and rear end of the train before leaving the yard.

HANDLING FREIGHT TRAINS ON LEVEL DIVISIONS

The trains on level divisions should consist of all through loads as much as possible, and the train should consist of as much tonnage as the locomotive can handle and make an average speed of at least 14 miles an hour. If it is necessary to fill out a train with cars for intermediate points or to give the train local cars, they should be switched on the front part of the train in station order, so that only the cars to be set off will have to be handled.

With the long heavy trains that are being handled at the present time, after a train has started out of the yard it should be kept moving, for the stopping and starting is what causes delays and damage to equipment.

The train should not be stopped for coal over the division and should be stopped for water as few times as is possible. In making stops for coal and water, the engineer should be very careful not to make spot stops with a heavy freight train.

All long and heavy freight trains should be stopped with one application of the air brakes and the engineer should endeavor to keep the slack bunched from the front end. This can best be done by making the initial reduction just sufficiently heavy to run the slack in and follow up with light reductions until the train is stopped. In order to keep the front end from running out, the engineer should make a reduction of about eight or ten pounds about 60 ft. before coming to a full stop. This is to keep the air brakes applying stronger on the front end to hold the slack in and leave the brake applied on the train when the engine is cut off. Engines so equipped give splendid performances both from capacity and fuel economy standpoints.

In starting a train with one engine, the engineer must be very careful until he has pulled all of the slack out of the draw-bars before fully opening the throttle. There is about 9 to 12 in. of slack between the cars, and this will increase on the front end in starting, due to the compression of the draw-bar springs and the dead weight of the cars that have not been started. The engine will move about 60 to 70 ft. on a 70 to 75-car train before the rear end moves on the level and more on an ascending grade.

In starting a two-engine train on level roads, the lead engine only should start to pull and take up all the slack that it can. Then the second engine should start to pull by opening the throttle gradually until the entire train is started, then increase the throttle opening as may be required. The train should be moved at a slow rate of speed for a distance of just one train length, so that the trainmen can look over the train and in case any brakes are sticking they can be released. Very often it is possible to locate a defective coupler in the train when it would not be noticed at any other time, except when the train is stretched out so far. This will occur at times when couplers are badly worn and the draft spring broken or worn.

DESPATCHING TRAINS FROM YARDS

Where the yard is equipped with an air-brake testing plant, see that the brake pipe leakage is below standard allowance and all other work done before the train is ordered to leave the yard, so that when the road engine arrives in the yard it can be coupled onto the train at once and make the road test.

The success of the trip greatly depends on the start out of the yard. The importance of having the train ready to move by the time it is called is readily seen, for one hour delay at the start means overtime on the eight-hour day and 12½ mile an hour basis.

The train despatcher must not stop trains unnecessarily, for an avoidable stop made by a heavy freight train means a loss of time in stopping, then getting the flagman in and starting, and very often the train is parted in trying to start, due to a broken coupler or coupler slipping by which might not have occurred if the train had not been stopped. There is also an excessive amount of fuel consumed by the extra stops and in trying to make up some of the time lost by the stops.

There is no economy in loading a freight train so that it

* From a paper presented at the convention of the Traveling Engineers' Association.

is unable to get over the division without making overtime.

HANDLING FREIGHT TRAINS ON MOUNTAIN DIVISIONS

On divisions where the grades are heavy and it is the practice of using one or more helpers on the ascending grades, it is important that no weak cars be used in heavy tonnage freight trains, if possible to avoid it. With the Mallet and Santa Fe type locomotives having tractive efforts of from 70,000 lb. to 105,000 lb. cars with weak end and center sills or weak couplers are very dangerous to handle in trains of this kind. There should be instructions given to all yard masters and car inspectors that cars that appear to be old or of weak construction should be switched out of heavy trains where helpers are used and placed in a train to be run without a helper or a train hauling light tonnage.

It has been demonstrated from time to time that it is not necessary to use hand brakes on freight trains on descending grades any more than it is on passenger trains, when the equipment is properly maintained. With the ordinary air brake, if properly maintained and manipulated, it is possible to handle freight trains on heavy descending grades with the air brakes with a greater degree of safety than with the use of hand brakes, because it is possible to do the braking more uniformly throughout the train and to maintain a more uniform rate of speed.

According to the information obtained from the different roads, the permissible brake pipe leakage on trains of 30 to 100 cars varies from five to eight pounds per minute, which is about all the air feed valve will take care of and about the limit of leakage with which an engineer can do a good job of braking. It has been found by actual tests on heavy mountain grades that it is very difficult to release the brakes on the rear end of 75 to 90 cars with a brake pipe leakage of over seven pounds, and if the brakes are not released on the rear end after each application the tendency for jerking the train and excessive wheel heating is greater.

Some roads are handling trains on level tracks as well as on heavy mountain grades with electric power, and some other roads are figuring very strongly on electrification. While this method of operation applies only to a few roads, we are of the opinion that more roads will take up the matter of electrification in the near future from the fact that with the electric locomotive the terminal delays can be reduced considerably, as well as delays in stopping for water and coal, and it has been demonstrated that an electric locomotive can be run over three divisions of over 100 miles each, by changing crews, without any delays to the locomotive. This would indicate a high point of efficiency from the fact that it could be a no-stop operation from one end of the division to the other. This would eliminate the pulling out of draw-bars and damage to equipment due to starting and stopping. It would also reduce the cost of brake shoes and other brake equipment.

On heavy grades the speed of the train is controlled while descending, by regeneration, but it must be understood that by regeneration the speed of the train is only held under control and it will be necessary to use the air brakes to stop.

The report was signed by Frederick Kerby (B. & O.), chairman; M. O. Davis (A., T. & S. F.), M. A. Daly (Nor. Pac.), P. G. Leonard (G. H. & S. A.) and Malon Laquay (Grand Trunk).

Discussion

The greater part of the discussion was devoted to the best methods of making water stops with long freight trains. The practice of stopping short of the water crane, then moving the train up slowly to the final stop, was commented on favorably by a number of the members. Where the more common practice of cutting off the engine is followed, it requires from 20 minutes to 1½ hours to release and recharge the brakes after the engine has been recoupled to the train, the time depending on the amount of brake pipe leakage. Furthermore, some of the members have found that an actual reduction in the amount of damage to draft gears has been effected by the practice of moving the whole train slowly to the final stop. The reason given for this was that stuck brakes often follow the recharging of the train. It was evident that the roads where this practice has been adopted are comparatively level and handle trains ranging from 3,000 tons to 4,000 tons. The opinion was that where unusually heavy trains are handled or where grade conditions prevail the only safe rule to follow is to stop and cut the engine off before moving to the water tank.

The incoming test and the yard charging plant were favorably commented on. The yard charging plant saves from 1 to 1½ hours' crew time in getting away from terminals.

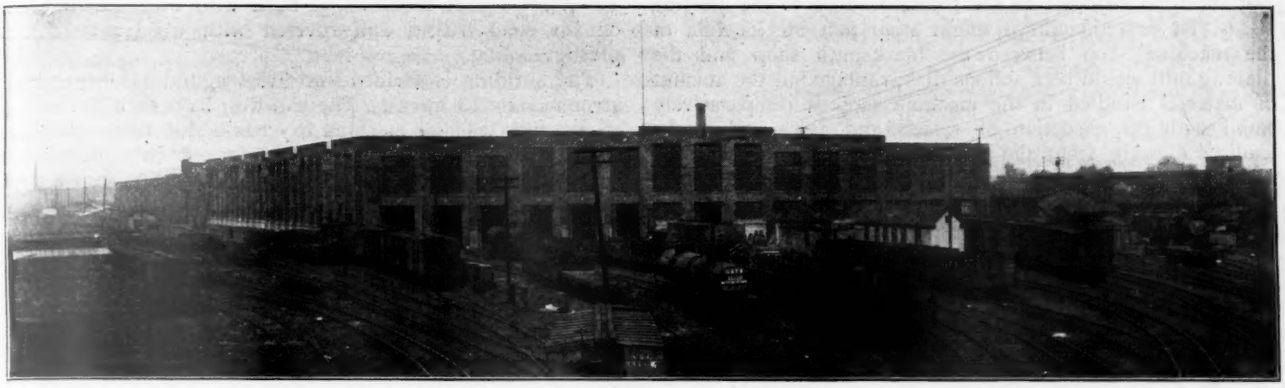
The effect of slack action has been found of more importance on electrified districts than it was when steam motive power was used. Where regenerative braking is used no trouble is experienced in making emergency applications of the air brakes on descending grades. But when ascending great care must be used to prevent pulling out drawbars. The practice which has been developed is to first apply the brakes, then shut off the power gradually to prevent the heavy run in of slack due to the higher braking power immediately developed at the front end of the train.

Referring to the statement in the report that freight trains can be handled on mountain grades with power brakes only, it was stated that in order to do this retainers must be put in good condition before descending the grades, and the greatest success cannot be attained unless all railroads maintain the brake equipment as the laws require. Otherwise, the mountain roads will be required to do an excessive amount of work to put the equipment in safe condition.

THE EFFECT OF SLACK WEDGES

A discussion on this topic was presented in a paper on the general subject of locomotive upkeep, prepared by a committee of which J. C. Brennan (N. Y. C.) was chairman. In the discussion which followed the reading of the paper several of the members dwelt on the fact that, aside from loose binders or thimble bolts, the cause for practically all failures of frames over the driving boxes is slack wedges. Some difficulty has been experienced in getting wedges properly adjusted in the roundhouse. Unless the locomotive is properly spotted the machinist is very likely to find it standing so that the wedges appear to be tight and he frequently reaches that conclusion when the wedges have been reported by the engineman to be set up. The Franklin self-adjusting wedge was favorably commented on by representatives of the railroads on which it has been applied, some of the members reporting a decided decrease in the number of broken frames on classes of locomotives now equipped with this device. These wedges have been run for six months without touching the adjustment but all of those who have had experience with them emphasize the necessity of keeping them lubricated. In some cases it is the practice for the inspector to oil the wedge a little before each trip.

The difficulty of securing proper attention to the usual type of wedges on engines in pooled service was mentioned. In pooled service the Canadian Pacific has developed the practice of giving each engineman a copy of the work report turned in by the man who last had the locomotive, as a means of developing a more intelligent interest in the condition of locomotives on the part of the crew. It was also suggested that excellent results might be obtained if each engine man were given a copy of his work report, showing the conditions actually found in the roundhouse. This would tend to correct habitually wrong diagnoses on the part of the enginemen.



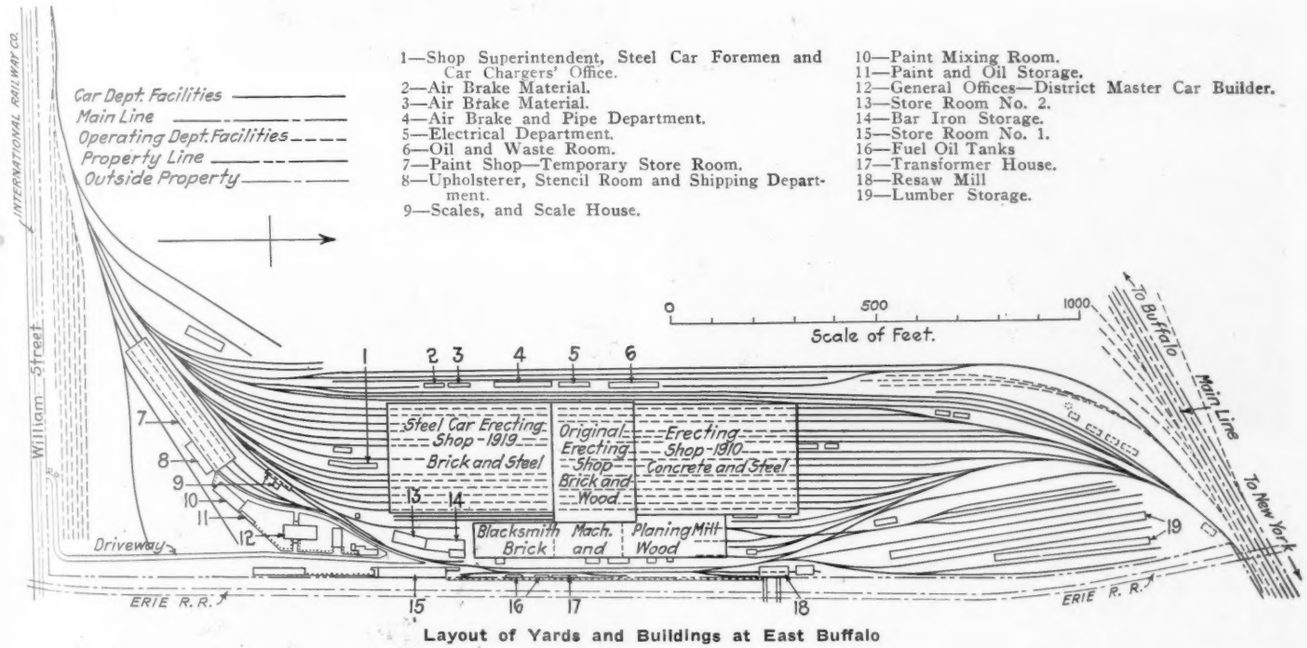
General View of the East Buffalo Car Shop

N. Y. C. Steel Car Shop at East Buffalo

Capacity of Building with Latest Additions 236 Cars; Overhead Cranes Eliminate Need for Material Tracks

THE New York Central maintains at East Buffalo, New York, the largest freight car shop on the system and probably one of the largest in this country devoted primarily to the repairing of freight cars. The original shop erected in 1865 has been greatly enlarged, extensive additions having been built in 1910 and in 1919. At present the buildings have a capacity of 218 freight and 18 passenger cars while the adjoining repair tracks provide space for 170 freight and 12 passenger cars. The force employed under normal conditions comprises about 900 men in productive labor and 75 in the supervisory positions.

The East Buffalo car shop is located south of the main line of the New York Central and extends for more than a half mile alongside the freight yard. The layout centers around the erecting shop, which is 275 ft. wide and 1,000 ft. long, this building alone covering an area of 6.3 acres. The drawing below shows the three portions of the shop—the original erecting shop at the center with the addition built in 1910, both of which are used for repairing wooden cars, and the new shop for steel car work built in 1919. The wooden car department covers an area of 275 ft. by 600 ft. while the steel shop is 275 ft. wide and 400 ft. long. Adjoining the erecting shop on the east side is a brick building 605 ft. long and 85 and 110 ft. wide in which are located the planing mill, machine shop, blacksmith shop and power house. The blacksmith shop is 85 ft. by 200 ft.; the machine shop 85 ft. by 160 ft.; and the planing mill 110 ft. by 200 ft.



Layout of Yards and Buildings at East Buffalo

With this arrangement, an excellent routing of material is secured. The storehouses for castings, bar iron and finished material are at the south end of the shop, where they are most accessible to the blacksmith shop, while the lumber storage is easily reached from the north side of the planing mill. The machines are so arranged that the material is brought in at the ends of the shops and passes along without back movement for the successive operations and leaves the

last machine adjacent to the tracks leading to the erecting shop. At first thought it might seem that the location of the machine shop between the blacksmith shop and the planing mill would be a serious disadvantage but the amount of material handled in the machine shop is comparatively small with the exception of wheels and axles and tracks leading directly from the erecting shop are provided for handling these.

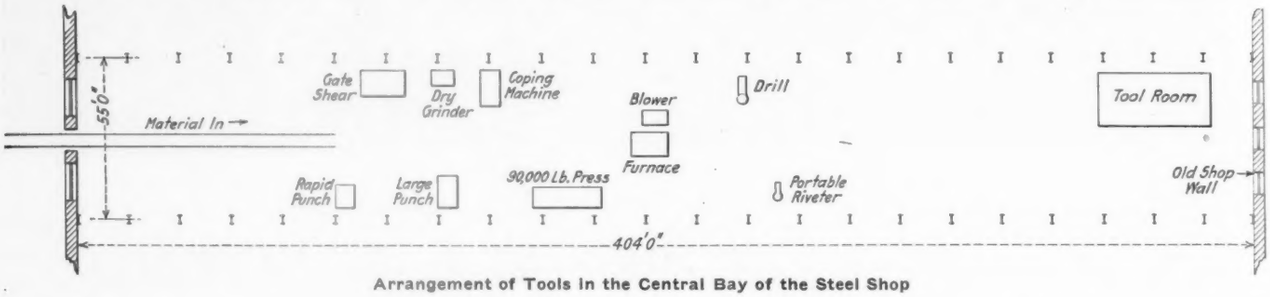
The power house occupies a space 45 ft. by 85 ft. between the planing mill and the machine shop. The electric power used in the shop is purchased from outside sources and this small area is ample for the boilers, pumps and compressors. A separate building opposite the machine shop houses the transformers and the switchboards for the main circuits. The combined rating of the machines used in the shops is 2,378 h.p. Steam power which is used for the steam hammers, for heating and for the fire pumps is supplied by one 100 h.p. and two 200 h.p. locomotive type boilers. Two air compressors each of 1,500 cu. ft. capacity and driven by synchronous motors furnish compressed air for the shops.

The auxiliary buildings have been placed in convenient locations with respect to the main shop. A separate building is provided outside the planing mill for the resawing of second hand sills and other large timbers which can be worked over into smaller sizes. A paint shop 60 ft. wide by 360 ft. long with a paint mixing room adjacent is located at the south end of the shops. Owing to lack of space, this is used temporarily as a storehouse. The air brake department, electrical department and oil house are housed in separate buildings west of the main shop.

As the new steel car erecting shop represents the latest practice in construction and equipment, a more detailed description will be of interest. The shop is of brick and steel construction with concrete footings extending to a height of about six feet around the walls. Both the side and end walls have a large window area, ribbed glass and pivoted steel sash being used throughout. The roof, which has six transverse square monitors, is built with wood purlins laid on the steel trusses and covered with wood planks and plastic roofing.

The building is divided into five longitudinal bays which accommodate 13 tracks. The two west bays each have three tracks, the center or machine bay has a stub track, and east of this is another bay with three tracks. Each of these bays has a 10-ton traveling crane of 51 ft. 4-in. span with a two-ton auxiliary hoist. The extreme east bay has three tracks but is not supplied with a crane. The lavatories and lockers are located on a balcony in the north end of this bay. The tracks are spaced 12 ft. 6 in. from the walls and 17 ft. 2 in. and 18 ft. between centers without any intermediate tracks for handling material or working on trucks. The truck work is done while the trucks are rolled clear of the end of the car and material is transferred by the overhead cranes. This arrangement eliminates waste space in the shop and increases the car capacity. A transfer track extends across the north end of the steel shop and provides a convenient means for transporting material from the machine shop or blacksmith shop to any of the tracks in the five bays.

The arrangement of the equipment in the steel car shop



Arrangement of Tools in the Central Bay of the Steel Shop

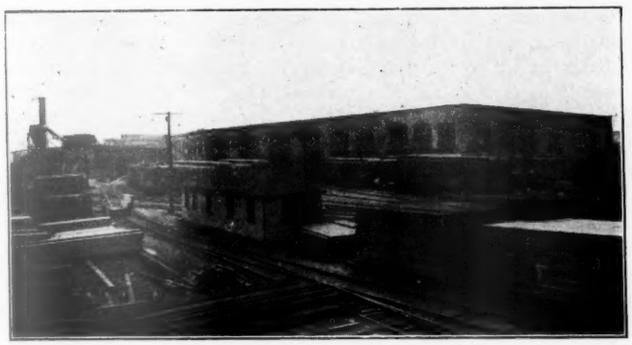
One of the Erecting Bays

South End of New Steel Shop

Looking Down Central Machine Bay

is shown in one of the illustrations. Comparatively little equipment has been installed, as prior to the erection of the shop the standard material for system equipment was made at other points and this practice is still followed to some extent. The machine facilities are ample to take care of the cutting and shaping of any parts that the shop is called on to replace. One piece of equipment that is worthy of special mention is a 90,000 lb. geared power press which has a capacity for bending ⅜ in. plates 10 ft. long.

While an extended description would be required to present a detailed account of the handling of work in the various departments, the list of machines shown herewith will serve to give an idea of the equipment needed for a shop of this size and the work that can be handled.



North End of the Erecting Shop, Planing Mill at the Left

LIST OF MACHINES, EAST BUFFALO CAR SHOP

BLACKSMITH SHOP

One power punch	One flanging clamp
One 2-in. bolt cutter	One 4-in. forging machine
Two 300-lb. Bradley hammers	One brake shoe key machine
One 1-in. bolt header	One single head bolt cutter
Two 2-in. bolt headers	Two 1½-in. triple head bolt cutters
One No. 4 bulldozer	Three 2-in. triple head bolt cutters
One No. 9 bulldozer	One tire lathe
One pneumatic bulldozer	One heavy duty drill press
One bolt shear	Two 3,400-lb. steam hammers
Two No. 5 Hilles & Jones punch and shears	Electric motors, total 157½ hp.

TIN SHOP

One wire machine	One burring machine
One double truss Cornish brake	Two turning machines
One 42-in. squaring machine	One 2-in. roller machine
One No. 24 punch	One 3-in. roller machine
One 18-in. bar folder	Two heading machines
One 42-in. bar folder	One Superior small turner

WOOD REPAIR SHOP

Two 10-ton traveling cranes	One cross-cut saw
One rip saw	Electric motors, total 15 hp.

WASTE RECLAIMING DEPARTMENT

Two waste reclaming machines	One emulsion machine

PIPE DEPARTMENT

One No. 7 pipe machine	One angle cock grinder
One pipe cutter	Electric motors, total 10 hp.

RESAWING MILL

One cross cut-off saw	One exhaust fan
One band saw	Electric motors, total 65 hp.

MACHINE SHOP

One speed drill	One water pump, 10 in. by 8 in. by 12 in.
Two No. 3 milling machines	Three engine lathes
One 18-in. drill press	Two double end axle lathes
Two stand grinders	Two single end axle lathes
Three boring mills	One planer
One grindstone	One shaper
Two hydraulic wheel presses	One drill press
One blower	One radial drill
One journal truing lathe	One hydraulic press
One 1,000-cu. ft air compressor	One Universal grinder
One water pump, 12 in. by 8 in. by 12 in.	Electric motors, total 235 hp.

WOOD MILL

One column bracket cut-off saw	Two matchers
One cross cut-off saw	One gainer
Three swing cut-off saws	One timber framer
Four rip saws	One turning lathe
Two band saws	One trimmer
Two horizontal boring machines	One saw sharpener
One horizontal angle boring machine	Two band saw filers
One vertical hollow chisel mortiser	One band saw setter
One horizontal mortiser	One band resaw stretcher
Two vertical sill tenoners	One band resaw lap grinder
One door and sash tenon machine	One planer knife grinder
Two moulding machines	One exhaust fan
One shaper	One band saw
One 4-side planer	One combination machine
One dimension planer	Electric motors, total 447½ hp.

THE UPKEEP OF FREIGHT CAR EQUIPMENT*

BY J. W. SENGER
Superintendent of Rolling Stock, New York Central Lines West

Those who are directly connected with and responsible for upkeep, care and maintenance can best appreciate the difficulties experienced in passing through the period of the war. At the present time during the reconstruction period, due to the shortage of labor and material and the increased traffic that is moving and the scarcity of freight equipment, we are facing perhaps a bigger problem than the one with which we had to contend during the great conflict for the period mentioned. During the past three or four years a limited amount of freight equipment having been purchased, it is necessary to maintain equipment that in normal times would have been retired. Therefore, in order to bring this subject before you the writer has confined himself to the most important parts and divided the subject as follows: Facilities, Material, Organization and Repairs.

FACILITIES

Facilities are the most important factor in car repairs next to labor. Up-to-date shops equipped with modern machinery and labor saving devices being limited to taking care of the equipment, it must be realized that a 100 per cent output cannot be had at all times; particularly is this true during the winter season. For obvious reasons the facilities for repairs have not kept pace with the increased equipment. This matter should be one of careful consideration with a view of increasing the facilities as quickly as possible.

ORGANIZATION

Shop organization is also a vital point and in order to produce the maximum output should consist of capable men. The most important of these are the shop superintendent or general foreman and his assistants. It is generally found that when the work is divided better results are obtained than to have the entire shop or shop yard covered by one man, as this practice makes the head of each division responsible. Junior supervisors should be educated to fill the position immediately ahead of them, so that in the absence of the foreman the work will proceed without loss of efficiency.

Men in supervisory capacities should be selected from the ranks when possible to do so. This practice is an incentive to others. They should be men of a good personality, broad minded in their dealings with men and thoroughly conversant with the details of the work.

Valuable results are obtained by holding monthly meetings of the supervisors, bringing them into closer touch with each other and the practice in vogue at their respective points. Meetings places should be changed from time to time giving to all an opportunity to observe the conditions at the different points. Much valuable information can thus be obtained that will result in saving and greater efficiency and due credit given to those who are responsible for same.

MATERIAL

The shortage of material is a handicap in production, often necessitating the substitution of one kind for another. Careful attention should be given to the use of material, that none is wasted and all is used to the best advantage. Full cooperation should be had between the mechanical and stores departments in the handling of material that no unnecessary delay be had in supplying material at hand. Advantage should be taken of the scrap dock, as much good material can be obtained. The necessary machinery and supervision to reclaim material should be furnished.

REPAIRS

Under this heading the writer has divided the subjects

*Abstracted from a paper presented before the Central Railway Club, September 10, 1920.

into three classes; viz: general repairs, light repairs and running repairs:

General Repairs: This refers to both wooden and steel equipment receiving heavy repairs or that are rebuilt, at which time due consideration should be given to the strengthening of all weak parts, the application of betterments, such as steel underframes, steel ends, improved doors and fixtures, etc., the thorough overhauling and modernizing of trucks, eliminating unnecessary parts and bolts, and providing safety irons to prevent brake beams falling down. After the completion of general repairs a final inspection should be made to know that all parts are in a serviceable condition before the car is released for service.

Under this heading, I want to call attention to the importance of a final inspection at the shops after cars receive heavy or general repairs. This should be done by very competent men who should go over each and every part carefully, see that all the movable parts of the brake equipment are in their place, especially cotter pins, which should be properly spread, and other small items likely to cause failures en route and which the car repairers overlook—in other words, when a car leaves the repair track it should be O. K. for service in every particular.

I also want to call attention to a lot of old and worn-out equipment now in service and which, in my opinion, ought to be retired. If you will look over some of this equipment when it is on your repair tracks you will find that a large percentage of the cars have been given temporary repairs to carry another load or two. It seems to me we are only wasting a lot of good money by trying to keep such equipment in service; besides, it is taking up a lot of valuable repair track room which could be utilized to better advantage.

Light Repairs: Under this caption the writer refers to cars repaired on the ordinary repair track and comprises such repairs as replacement of draft timbers, end sills, sill splices, parts of floors, parts of roof, doors and door fixtures, journal boxes, column castings, truck bolsters, side bearings, brake beams and connections, etc.

Cars on light repair tracks should be gone over carefully for defects which may send them to the heavy repair track and avoid making light repairs when the condition is such as to warrant general overhauling. In connection with the light repairs enumerated, attention should be given to the brake equipment doing all the necessary work to put the brake in first-class operative condition.

This is also an opportune time to inspect the car for worn parts, spreading of cotter keys, adjustments of the piston travel, seeing that proper connections and brake levers are applied and that the hand brake and uncoupling levers are efficient, and periodical packing of boxes. If this is done is would prevent the cutting out of cars when returned to service.

Running Repairs: This is generally understood as repairs made in the classification or train yards, either by inspectors or follow-up men. Right here I wish to impress upon everybody's mind the importance of having the little things taken care of which are at times neglected; that is, renewing short or broken knuckle pins, worn-out brake hangers and keys, bolts, the application and proper spreading of cotter keys, removal of worn brake shoe keys, application of missing parts and correction of Safety Appliance defects. At this time the hand brake should also receive a thorough inspection, journal boxes should be examined to see that brasses and keys are in place, that no sign of previous heating exists and that packing is in its proper place and that there is enough lubrication to run the car to its destination. By giving proper attention to cars in the classification yards which, of course, includes proper inspection, nearly all of our road delay and expense of setting out cars en route could be avoided.

Quite frequently we hear complaints from other departments on account of too much time being consumed in inspection and repairs in the classification yards. Inspection and light repairs are very necessary to insure the train going safely to its destination without delay. While the work should be done as quickly as possible we should insist upon proper time for inspection and repairs being allowed to accomplish this.

In conclusion the equipment department of the railroads is passing through and experiencing one of the most strenuous periods of its history. The demand that has been made upon it by the operating department of the railroad, due to the necessity for car equipment suitable for transportation purposes, has tended to make it necessary to use all classes of equipment to the maximum. We have been called upon to supply cars not for the commodities for which they were originally built, but for other classes of service for which they could be fitted by temporary repairs. As a consequence we now find ourselves with equipment on hand which will require some time to build up to its former usefulness, and this cannot be very well accomplished unless all railroads provide themselves with newly constructed equipment which can be placed in service to relieve equipment now running, to enable the cars to be brought into the shop and receive general repairs or overhauling which will fit them for the service for which they were originally built.

Discussion

F. W. Brazier (N. Y. C.) in a written discussion considered what could be done to reduce the cost of upkeep. He advocated more care in designing and getting comments from the foremen to do away with troublesome defects. More thought should be given to the type of equipment to avoid features that are expensive to maintain. As an example, he cited the elimination of unnecessary nuts and bolts and also mentioned improved door fastenings and key connected couplers as important improvements. Undue emphasis is often placed on reducing the first cost of equipment; but if the design of cars built years ago had received more attention, conditions would be better now.

C. H. Hogan (N. Y. C.) expressed the opinion that the most important matter at the present time is the question of organization. Handling labor is difficult and requires men of good judgment. The foremen should get close to their employees and study their character if they wish to secure a fair day's work.

F. C. Pickard (D. L. & W.) pointed out that the freight car situation is of extreme importance from the maintenance standpoint because 25 to 35 per cent more is spent for the maintenance of cars than for the upkeep of locomotives. He ascribed the present difficulty to the fact that during government control only 100,000 cars were purchased and practically none retired, while, normally, in this period the roads should have bought 550,000 cars and retired 600,000. While the bad-order cars on individual roads range from 6 to 15 per cent according to reports, Mr. Pickard expressed the opinion that a thorough inspection would show 30 to 40 per cent in bad order. Many cars now in service should be retired, particularly those with short draft timbers and with center sills cut to allow the bolster to pass through. He brought out that some roads have good facilities for repairing freight cars, while others are poorly equipped. To improve the bad-order situation, each road should contribute its share to maintaining the cars. He mentioned the damage to cars resulting from impact at excessive speeds as an important cause of damage to freight equipment.

J. E. Gordon (N. Y. C. & St. L.) mentioned the damage resulting from improper loading and G. J. Charlton (D. L. & W.) advocated the employment of inspectors at loading points to insure the observance of the loading rules. T. A. Ward (N. Y. C.) brought out the fact that 7 per cent of the loss and damage claims are due to defective equipment.

INTERCHANGE INSPECTORS AND CAR FOREMEN MEET

Discussion of Revision of Interchange Rules and Paper on Transfer and Adjustment of Lading

METHODS for increasing the efficiency of operation and expediting the movement of cars were the keynote subjects at the convention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America which met at the Hotel Windsor, Montreal, P. Q., on September 14, 15, and 16, 1920. The attendance was probably the largest at any convention of the association; the two hundred railroad men who registered represented railroads and private care lines in all sections of the United States, Canada and Cuba.

The first session was opened on Tuesday morning by President J. J. Gainey, who called upon Captain A. Layman of the Salvation Army for the opening prayer. Alderman J. P. Dixon, representing the city of Montreal, then welcomed the convention. T. J. O'Donnell, replying to Alderman Dixon, expressed the thanks of the members for the cordial reception and the pleasure of meeting in the Dominion of Canada, for which the people of the United States have such a kindly feeling. He also touched on the importance of the work of the association in caring for 2,500,000 freight cars and 60,000 passenger cars and creating uniform ideas in regard to interchange on all American railroads.

J. J. Gainey (Southern)
President

E. Pendleton (C. & A.)
First Vice-President

A. Armstrong (Atlanta, Ga.)
Second Vice-President

J. C. Keene (Bradford Draft Gear Co.)
Secretary-Treasurer

Address of President Gainey

Following Mr. O'Donnell's response, President Gainey spoke as follows: Mr. O'Donnell has expressed my wishes all the way through and has left very little for me to say. I am glad to see as many ladies and gentlemen present as we have here this morning. I really did not expect so many to come on account of the long distance to be traveled. You all know the object of our meeting. It is printed on our invitations, and the most important part of that is "National harmony and unity of action, everywhere by everyone." If all the members of the association live strictly up to that, it will make our work each day less laborious and more pleasant.

The report of the secretary-treasurer was read and sent to the Auditing Committee, after which the reading and discussion of the paper on Transfers and Adjustments of Lading for Mechanical Defects was taken up.

TRANSFERS AND ADJUSTMENTS OF LADING FOR MECHANICAL DEFECTS

BY J. M. GETZEN
Ass't Chief Interchange Inspector, Buffalo, N. Y.

"Money expended for productive labor is an asset, but when used to correct omissions and errors is a debit against the railroad paying it and the country as a whole." Under this standard, I wish to open up the discussion on transferring bad order cars and adjusting loads.

Acknowledging the necessity for transferring cars, we have an even division between unavoidable failures and misjudgment of selection of equipment. Among the former we may class: 1. Failures of inherent defects. 2. Failures through accident. 3. Failures through switching. In this category we must allow for natural causes: parts of cars will break, accidents will happen and our friends, the switchmen, will break up their quota of cars no matter how well regulated the organization may be.

In the latter class are: 1. Cars loaded in defective condition. 2. Cars unfit for bulk or high loading. 3. Cars too large for road clearances. We might go on indefinitely with reasons but from my observations most failures are comprised in these three and involve the carman mostly.

The judicious selection of equipment for the load it is fit to carry, is today the most vital means to reduce transfer, repairs and kindred troubles of the carman. The shortage of freight cars in practically every line of trade and its ever increasing demand seem to incline toward skimping on the general repairs and for this reason we must take the car as it stands, and here it lies in our power to classify it properly and prolong its life and usefulness.

To illustrate this clearly—there is not a time when we go over the cars but we find some of them plenty good enough for coarse freight, loaded with grain, leaking through ends and sides, the door post held in with a brake lever bolted through the sill, and adjoining it a first-class box car carrying barrels of oil or tar that had sprung a leak and ruined it for future high-class loading.

Another example is a twisted and contorted 50 ft. furniture car loaded 4/5 full of lumber. It was never designed

Chief Interchange Car Inspectors and Car

for this purpose and will not carry such a load safely. Generally speaking such are our transfers for body defects and hand in hand with it, cars loaded in defective condition. I do not think it necessary to enumerate the specific defects on truck or body that embrace such cars as we hew close to the rules. I might say, go a little better in repair rather than take advantage of the rules. May I not inject a compliment here to our private car owners, especially the packers? Never in my experience have we operated better equipment carrying the highest class freight we know of than we are at this time and they deserve the compliment unstinted.

Next we shall consider the adjustment of loads, and may I not pronounce this the most aggravating byproduct of carelessness? The greatest number of failures occurs unquestionably on house cars—"bad load at side door and door out"—due to no doorway protection in violation of Rules 1700 to 2908 of the Loading Rules covering the loading of various commodities in house cars. Why this should continue year in and year out is a mystery only partly solved and I am leaving this as a question to see if your experiences correspond with ours in trying to overcome the difficulty.

Open loads have the greatest inclination toward distress and too much care cannot be exercised in properly staking, wiring or blocking such loads. Most prominent are stone, pipe, spars, lumber, machinery, etc. Long hauls, and terminal switching dislodge such loads with even the best of blocking and if our shippers could be educated along the lines to secure their loads for sway and motion, much of our trouble and their own complaints would be overcome.

Automobile shippers, working with a committee of the A. R. A. have solved their troubles by religiously following their recommendations and their bad loads are practically zero. Why cannot the other shippers follow their example? Perhaps they have not yet realized that a little initial expense expedites their freight, keeps the car out of the repair track, and reaches the customer quicker and he is more satisfied than if delayed and damaged en route.

Transfers and adjustments converted to dollars and cents mean in our association that we pay between ourselves approximately $25,000 each month to correct these omissions and errors, and while this figure appears large, the number of transfers and adjustments is nominal for a large terminal, the percentage being 23 cars transferred out of every 10,000 handled and 6 adjustments out of every 1,000 cars handled. We are keeping this percentage low only through most extraordinary efforts of our car foremen repairing everything within their power under load.

In conclusion, I want to add the appeal of our operating departments in their efforts to bring the car mileage up to 30 miles per day and lend our efforts toward this end by correcting as far as possible such errors by education and observance of the rules as they are given us.

Discussion

F. W. Trapnell, (Kansas City, Mo.): Mr. Getzen stated that a majority of the foremen were bending every effort to repair everything possible under load, in place of demanding a transfer. We are working along the same line. Everything that can be repaired under load is repaired, thereby obviating transfer and delay of the load incident thereto, with the claims that will accrue from the transfer by the change in the number on the bill of lading; whether there is any change to the contents or not, it will come and the railroad company will have to pay it.

E. R. Campbell, (Minn. Transfer Ry. Co.): In Minneapolis we transfer between 400 and 500 cars a month and in the Twin Cities probably 150 or 200 more. Most of our transfers are due to defective draft rigging and sills on open cars. At the Minneapolis transfer we have the large dray cars and we transfer and adjust loads. We aim to repair everything we can under load, especially commodities like automobiles and pianos, or anything of that kind. We have spent as high as $40 and $50 to repair a car and avoid a claim, because if we transfer a car of automobiles there is always a claim. We have spliced sills and put in new sills and draft rigging in that class of cars.

On the adjustment of loads, especially merchandise, nobody seems to pay any attention to door protection. We get all kinds of cars out of Chicago and I never saw a car loaded with merchandise that had any door protection. A car will come from us and go to Chicago and then there is a claim for door protection. In the milling district, all cars loaded with flour or feed are well provided with door protection and taken care of, but notwithstanding that, when they get down east, sometimes there is a claim for no door protection.

J. E. Vittum, (Columbus, O.): Most of the roads at Columbus, Ohio, repair their cars. I think that since we have the run repair or transfer system, the roads have been educated to make repairs on a larger measure than before, and those who have shop equipment, are making repairs to most of the cars offered in interchange, where the load has to be either adjusted or transferred. However, some of the points in our interchange are limited in their equipment and are unable to make the repairs as easily. I believe in the past two years, half of the cars that were formerly transferred because of defects are now repaired, and we have few transfers on loads at the Columbus interchange.

T. J. O'Donnell, (Buffalo, N. Y.): The paper that Mr.

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Getzen presents, is from everyday life. If we can eliminate any part of the $23,000 or $25,000 a month and put it in the treasury of the different railroads, we are doing our duty. You would be surprised to see the number of bad loads that we force the yard department to switch into the repair tracks every morning. There are at least three or four hundred and with the shortage of labor and transfer help, we switch them in with the feeling that they ought to load right at the initial point. If you are going to start a house car with two tiers of oil or vinegar, put in three or four cooperage boards to protect the doorway, because the center of the load will be up against that door and you will have to do it. Three dollars at the point of loading will be better than $5 or $20, or a wreck and loss of a life on the way.

We have been hammering at this for 20 years. The shipper ought to be made to put it in, or the railroad ought to be told for its own benefit; we will allow you the money that costs. The Interstate Commerce Commission told us that it is the duty of the shipper to protect his load. We ought to get this before the proper officials so it will have the desired effect.

I am wondering if it is a better investment to repair cars under load where you have a standing force and transfer platform, than to transfer them. You cannot repair a car under load as well as you can one that is empty. Are we patching up a lot of these sills to get the load through at the expense of the car? It is an open question whether you should transfer a car and repair the empty right when it is convenient to do so.

A. J. Mitchener, (M. C.): When I came to this division in May, we were transferring from 50 to 80 cars a day at a small point, Victoria. The average for the last three months is down now to 48. The repairs that we make to cars embrace the splicing of the center sill, draft timber and end sill, etc. We do not agree on some of the repairs, but as I look at it, it is easy for the repair track foreman to walk down a string of cars and mark transfer on them, but if you put a car on the transfer track, it sometimes takes a week; while you can repair the car under load in 10 hours. The foreman at Windsor couldn't agree with me on repairing cars under load, so I took 22 cars to St. Thomas, and agreed that if I repaired all of those cars under load, he would repair all of those that came after, and he is living up to his word.

A. Berg, (N. Y. C.): We handle the business on the line that has been outlined by those who have spoken before. We avoid transfer as much as possible, though it is permitted at Erie under the same conditions as at other points. It is the desire to avoid claims, and it is necessary to repair under load on account of the transportation department being unable to furnish men to transfer cars, but I do not believe it is a very good plan because we are not able to give the cars the attention that they should receive; especially is that true of the 60,000 lb. capacity cars. Another detrimental feature brought about by the new rules is, on account of the high rates that are paid, we studiously avoid making any more repairs than are absolutely necessary to keep within the expenditure. It is rather deplorable.

P. J. O'Dea, (Erie): During the past two years my activities have been directed almost exclusively to work in connection with valuation for governmental purposes. There seems to be a consensus of opinion that the number of transfers and adjustments are becoming less, and it would be interesting if we had some thing to base that on. Whether it would be worth the labor that it would entail is, of course, another question. In almost every field the number of transfers and adjustments in later years have been very much less than formerly, and that is due to the fact that the equipment, generally speaking, is better than it has ever been before, which is due largely to the activities of the interstate commerce inspectors.

Much stress has been laid on this question of getting cars home, and that is predicated, I think, on the assumption that if they get them home they will get everything that they should get to make them right. My own observation is that the cars usually receive at the hands of the other fellow just about as good quality of repairs and as extensive repairs as they receive on their own home road. Everybody will acknowledge that money spent for transferring and adjusting is not productive. It is a waste of money. The car is not made any better, conditions are not made any more favorable, and it affords the shipper an opportunity of setting up a claim that he might not otherwise make.

C. W. Maddox, (C. & O.): Several years ago we transferred and connecting lines transferred many against us, but we have noticed a decided improvement in the last two years. It has been our practice to educate our foremen and let them use their own judgment as to whether a car should be repaired under load or transferred. We can splice the sills, put in new draft timbers and end sills in dump cars, and make such repairs as can be done just as well with cars under load as empty. Cars in that condition, I think, should be repaired rather than transferred, especially of late years when labor is so scarce. But good judgment should be used. I think some will attempt to repair cars under load that cannot be given the necessary repairs to go to destination. It would be well for us all to watch the condition of cars very carefully when deciding to make repairs under load.

E. H. Mattingley, (B. & O.): I want to agree with the

remarks of Mr. Maddox in regard to making repairs under load. There are certain commodities loaded in box cars which oftentimes cause a car to be made bad order and the defects cannot be repaired under load as well as when the car is empty. For example, splicing of sills. Oftentimes where a sill has been spliced by the method employed while under load, you will find the holes for the bolts are made large enough to slip the sills, which in my mind only means that the car will carry the load to its destination and possibly result in elongated bolt holes, resulting in split sills, which is no remedy of the situation at all. If you can repair properly under load, do so; but if you cannot make a car safe and serviceable, transfer.

In my mind the solution of the whole matter is to get the load properly loaded at the initial point. To accomplish that result a good plan is to have some one familiar with the territory call upon the individual shippers. In some cases you will meet with the response that other roads will take the cars regardless of the loading. By having a chief joint inspector, representing all the roads, call on the shippers, we can get results. In the Youngstown district of the B. & O. with four or five roads, each road represented called at the various shippers pertaining to steel shipments and obtained fine results. By concentrating your efforts in that regard, I feel that you can better the situation.

W. F. Westall, (N. Y. C.): I believe if we follow the practice of the B. & O. and let shippers know that cars are being sent out of their plants which do not comply with the rules, it would be well. We often find that the shippers do not know that the cars are being delayed because of transfer or readjustment, on account of not having proper door protection. If that is taken up at originating points, I think it would better conditions. In regard to loaded freight cars and cars equipped for conveying oil, the only way that can be improved is to get the cooperation of the operating department as soon as the cars are parked.

M. W. Halbert, (St. Louis): We transfer 3,000 or 4,000 cars a month in the St. Louis district. I find a great many of them are transferred on account of not having proper facilities to make repairs. Every car should be repaired under load that can be put in proper condition. I also find that when the mechanical department has charge, there are a great many cars repaired and run that are going to be transferred when the transportation department has charge of it.

T. J. O'Donnell: Do you want to stand here and say that we are bluffing, we are crucifying our own jobs?

M. W. Halbert: When the car foreman has charge of the transfer of bad order cars in our district, he is responsible for the transfer. He gets busy and looks into the bad order situation; if he can repair a car he will do it. If it is set over on the transfer track and the transportation department has a gang of men transferring, he will transfer everything.

T. J. O'Donnell: Who is responsible for the transfers?

M. W. Halbert: The car inspector.

T. J. O'Donnell: Then isn't it our duty to see that we repair every car we can rather than disturb the load?

M. W. Halbert: Certainly it is.

T. J. O'Donnell: Then why do we say to our superior officers that we would have less transfers if they gave the work to us? One of our superintendents met me the other day in the yard and said: "We have turned our work over to the car foreman. We were getting congested with transfers; we will have about a third as many. I want you to give me a record at the end of 30 days how it works out." He had four less transfers and 80 more bad loads.

M. W. Halbert: When you put it up to the car foreman he is going to get busy. The inspector will mark a car for transfer, and the car foreman would not have a chance to look at all the transfers; perhaps they are 8 or 10 miles away, but in our district, when the car foreman gets busy on the transfers he is repairing cars and running them. He is railroading them through.

F. W. Trapnell: In our territory on some lines the car department takes care of the transfer, and on other lines the agent contracts for the transfer. We find that where the car department absolutely has the transferring of cars under its own jurisdiction, there are less transfers than when the superintendent or the agent has the transferring. Some of our connections are a long way apart. An inspector inspects a car and gets it for transfer; that car may be five miles from the car foreman. It is marked in on the transfer track and the agent starts in to transfer. When the transfer is placed with the mechanical department we will have less transfers than we have got today.

T. J. O'Donnell: A general car foreman should work on a mutual basis with the chief interchange car inspector. When a car inspector in a terminal yard condemns a car, he is not through with it. That car passes in to the repair track. It is up to the chief interchange inspector to see that that car isn't tampered with if it can be repaired under load. If you are going to leave the transfer of cars to the car inspectors you would be congested all the time.

F. W. Trapnell: In our report of the country there is a long distance between the repair track and the transfer track and the interchange tracks, and the man at the interchange tracks makes disposition of the car to the best of his ability, and it goes to the transfer track for transfer, and it isn't within ten miles of the foreman, or the general foreman. If he has to make a special trip that ten miles every day of course that is a different proposition. You have got a rather good supervisory force that we would consider could be done away with in our part of the country.

President Gainey: I agree with Mr. O'Donnell absolutely. I claim that the mechanical department is wholly responsible for every car that is transferred, whether it transfers it with its own force, or the transportation department transfers it. In Cincinnati our terminals are about 22 to 25 miles apart. In each large terminal we have a chief inspector. We have an inspector who goes through the entire yard the first thing every morning to see what cars the interchange inspector marked during the night. He examines these cars, and if in his opinion a car can be repaired, or is safe to run, he sends it to the repair track. Only cars that have to be transferred are sent to the transfer track. I cannot see why it cannot be done in every terminal in the United States. We transfer less cars coming from connecting lines than any road in the United States. We have gone as low as 15 cars a month, and we get the same cars going and coming that the other fellow gets.

In the last three or four months our transfers on all roads in Cincinnati have run higher than they should have run, and we have arranged for all the general car foremen of Cincinnati to get together and go through the entire terminal yards, and inspect the work of the inspectors, not saying anything to the inspectors of the time they are coming, and see whether the chief inspector who passed last on these cars is living up to what he is preaching. There have been more cars transferred against the C. & O. and the L. & N. and the Southern than on cars coming from the north. That is not due to the cars.

As Mr. Maddox has said, we repair 50 per cent of the cars under load. If a car is loaded with any commodity that you can splice the sills and nail the floor, you can do it just as well as you can empty and save the cost of the transfer. Every one of you knows that the transfer of cars is a waste of money, both for your company and the company that has delivered the car to you. I do not know of anything in railroading that will save more money for the railroad company than the stopping of transfers.

W. J. Stoll: At the large interchange points where a

chief interchange inspector is located, I do not see why any argument could arise when the general foreman and the chief inspector and his force cooperate. At our point we do not issue any transfer orders against any road unless we either see the car before or after it is transferred and by doing that, if one side transfers more cars than the other side, and we allow it, we are the fellows who are to blame.

A Member: I would say that the transfer of cars is on the increase. The paper that was read brought out the conditions about as we have it, while we have no statistics to back it up. I do not think anybody would be guilty of allowing a transfer if it could be repaired under load.

W. P. Elliott (Ter. Ry. Assn. of St. Louis): The transfer of cars not only should be charged to the car department, but they should have the transferring of loads under their jurisdiction. I know positively that you can reduce transfers. I know that in the Buffalo district and in the Chicago district there are cars being transferred today that could be repaired. We find a lot of cars are being transferred for lack of facilities to make the repairs and a lot are being transferred because the car foremen are sending cars to the transfer track on account of bad order condition. The result was to place the transfer of cars in the hands of the car foremen who were confronted with the problem of getting these cars transferred, as well as getting cars for the transfer, and we find it offsets his desire to shift the responsibility. If the matter is followed up closely by the car foreman, or the general foreman, as the case may be, it will eliminate a lot of transfers. Don't forget that the human element enters into it. There isn't a man here who won't sweep his own dirt before he will his neighbor's.

A. J. Mitchener: On June 10 we had 49 cars. I know we moved the cars. There were 49 cars waiting for transfer. In four days we repaired 46 of them. I am keeping a record of cars transferred against us by connections and I would be ashamed to hand a car back to a man for transfer for the small defects that they transfer against us.

W. P. Elliott: I want to substantiate everything Mr. Halbert said and I want to express my thanks to Mr. Getzen for the paper.

Secretary Keene: I move you that we close the discussion and tender a vote of thanks to Mr. Getzen for the valuable paper.

The motion was seconded and carried.

Tuesday Afternoon Session

At the Tuesday afternoon session the secretary read communications from F. H. Hanson, F. W. Brazier, F. C. Schultz and A. Armstrong.

F. W. Trapnell: I move you that our secretary be instructed to acknowledge these letters and telegrams by telegraph.

T. J. O'Donnell: While we are checking up our old friends let us not forget Henry Boutet and Stephen Skidmore. Let us send them a telegram, for they were really the bulwark of this association. (The motion was unanimously carried.)

The convention then proceeded to discuss the changes in the A. R. A. rules.

Changes in Rules of Interchange

Rule 2, paragraph 3. Loaded cars offered in interchange must be accepted with the following exceptions:

Section (c). Cars improperly loaded (not complying with the loading rules) when transfer or rearrangement of lading is necessary.

Cars loaded in excess of the maximum of Column A table under Rule 86, which is the total weight of car and lading on rails for receptive dimensions of axles shown.

A Member: Our practice at the present time where cars are transferred going home, is that they are sent home by the receiving company, so that a car can move home without any heavy repairs, if the car will go back.

T. J. O'Donnell: If we transfer a Burlington car against the N. Y. C. have we a right to return that car to Chicago?

W. J. Stoll: If the car is safe to go, yes.

T. J. O'Donnell: We had a car in our district that was home 80 miles from where we transferred it. It happened to be on a road doing business for two lines jointly. They said they would not take that car home; that we should get the receiving line to bill it home. I appealed to the officers that it was a reciprocal arrangement, that we could return empty cars from 1 to 300 miles providing the road connected direct with the owning road.

W. J. Stoll: That can only be handled locally by the officials of the different roads. It is a good arrangement.

M. W. Halbert: If the car is to be transferred and it does not belong in the St. Louis district we hold the delivering line responsible. If the car belongs in that terminal, it doesn't make any difference what the condition is, we send it to the home line, but otherwise a foreign empty car after transfer is returned to the originating line.

T. J. O'Donnell: Suppose the car belonged home 100 miles away, in defense of the road that transferred it, wouldn't they deliver it?

M. W. Halbert: They would not. It would be fair if we could get the roads to handle it that way. Under our arrangement, the trunk line handling the car will have to pay five cents a mile also per diem to get the car home. The line that did not originate it, isn't going to haul it home for nothing. The originating line will have to make disposition of that car.

T. J. O'Donnell: Wouldn't you recommend that that be done?

M. W. Halbert: Some of the roads will take it but if a car is out of commission why should any direct line haul it home for nothing? They never get a load haul out of it. But if we can make arrangements with the owners or the handling line and bill the car and get five cents a mile, we can handle it.

A. Herbster: In Chicago a car, even though not belonging to a Chicago road, and held by a road not connected direct, can be delivered to a road that has direct connection in order to get the car home. That has worked out very nicely. The Chicago district has been relieved of a great many bad orders, and I think the thing to do, even though it isn't as the rule reads, is to recommend that it be done universally.

T. S. Cheadle (R. F. & P.): Suppose road A delivers to road B a car loaded with a commodity which can be handed on to road C. The car isn't fit for any other commodity. They didn't bad order the car but permitted it to move through to destination. Possibly two months after, the car comes back; should that car be received back by the delivering line? Suppose no record was made of the car at the time it was received, but inspection showed that the same condition does exist.

C. W. Maddox: If a car is delivered and has to be transferred, and it does not belong to the receiving line, it should be returned to the delivering line for transfer.

A. Herbster: At the large interchange points they are not handled that way. If this thing works out all right at the large points, it certainly ought to work at the smaller interchange points where they have a chief joint inspection bureau. I believe it is good policy to get a car home and get it fixed up rather than holding it a year or two.

M. W. Halbert: During the war we handled the bad order situation as we had a mind to, and in St. Louis we had no congestion because any car was home wherever it was. We could start a bad order over some line and get rid of it, but today it is different. If the transportation department would leave it to us, we could handle the proposition very nicely; we could give and take, but some roads say "We won't haul that car 500 miles unless you pay us five cents a mile, or repair the car." If you get a car in that condition and can put it in condition to be loaded for

any kind of freight, it is a serviceable car, according to the rules. If you can get a load for the car and make it fit to go over the other fellow's line, you can start it, but an empty car, you cannot pass along unless you pay the road for hauling it.

Valentine Blatz (Wheeling): I fail to find anything in the A. R. A. rules stating that the smaller interchange points are governed by the action of the large interchange points. If we interchange a car and it is transferred for certain defects, there is no other way except to return it.

F. W. Trapnell: I move you that it is the sense of this meeting that the proper interpretation of that rule is, where a car is received by a road in bad order necessitating transfer of the load, that the car when empty be returned to the delivering line. (Motion seconded.)

M. W. Halbert: I think there ought to be a little added to it: A car home in the terminals will be sent to the owner.

F. W. Trapnell: I did not mean it that way. The car service association does not intend it that way. If I have a New York Central car and am connected with the Erie, in lieu of turning it back to the Erie, I give it direct to the N. Y. C. to save switching.

The motion made by Mr. Trapnell was carried.

T. S. Cheadle: Suppose the car was received and was not marked bad order. We get stock cars with pig iron delivered to another road. It is defective for a stock car. No record was made of it. Do the rules require that a record be made of it? Suppose it is loaded with watermelons and unfit for anything else.

T. J. O'Donnell: Then the car is traveling on its right. The physical condition showed that the car was such that it would carry the load.

T. S. Cheadle: It was fit for the load going up but it would not be fit on another line.

A Member: The car might not be fit for grain, but you could utilize it for something else.

Mr. Elliott: The reverse might happen tomorrow. These things are reciprocal, as I see them.

President Gainey: If I delivered to you a car to which you took no exception and you had it two months and returned it to me in bad order I would tell you to take care of it.

A Member: Under Rule 2, the car must be accepted back if in the same condition. We had a car loaded with coal with the dump door boarded over, delivered back with the boards gone. They put the boards back on and delivered it back to us in the same condition.

J. M. Getzen: The gentleman bringing up this question has failed to protect himself, in accordance with paragraph J. He admits it was defective when he got it. It was a trap door missing and boarded over. If he had put on "Bad order. Return when empty," it would have come back without any trouble.

C. W. Wolfe (Southern): Reduce the two months to two days. Could you tell him to keep it?

President Gainey: Not for two days. I will agree with you.

C. W. Wolfe: You cannot give it back unless you put a card on there, or make a record.

President Gainey: But he says he has no record of any defect when the car was delivered. He takes it and keeps it for two months and then brings it back and gives it to the delivering line.

C. W. Wolfe: I followed that for a long time but I made up my mind I would make a notation of it.

T. S. Cheadle: I confined myself entirely to the second paragraph of Rule 2. I am trying to see what the application of the rule is where the movement of one class of lading is through your line over to another line, and the car is moving back. The condition is the same, and if loaded with the same commodity it would be all right. The car isn't fit for anything but that class of loading. If you had to make a report of it you would write the initials and numbers of the entire train of 80 cars and would delay the shipment. It seems to me that this rule can be applied as written in the second paragraph when it is on its home route, and that it should be received regardless of whether any record was made of it.

W. A. Rogers (P. & L. E.): As I understand it, it is a question of a car received in interchange, without any records taken as to its defective condition; that car, if moving backwards in home routing, must be accepted if in the same physical condition as when forwarded under load, whether empty or loaded. If I accept a car under load without any objection, the car is mine. The only way you can get rid of that car is, having a direct connection with the owner, or the car being in the same physical condition that you took it under load. You cannot deliver that car back in defective condition simply because you failed to protect yourself, providing it isn't moving on home route. If you get a car under load, you can deliver that car back empty if in proper home route, providing the record shows that your first receipt of the car is also your home route record.

T. J. O'Donnell: Isn't it a fact that we must have 30 or 40 per cent empty mileage? We cannot get loads all the time. We get 50 cars of watermelons. They are loaded on light cars without doors. We cannot load them over the road that gave them to us. We deliver them and I never hear about it. The car service department is utilizing these cars to take steel and coal. We have got to get our empties back to the mines. We are taking cars every day and if a car is delivered within a reasonable time the inspector never raises a question. The empty goes back the same as the load came up. We have got to stand by the handling of the car.

W. A. Rogers: In the Pittsburgh territory we have one road that is congested with bad order cars. They have taken it upon themselves to procure home route record, starting that car on a 2, 4 or 8 months' record. I say that the receiving road accepting that car under load, hauled that car to its destination, and if they find that car at the end of its destination is not fit to carry another load, I don't care whether it is chip baskets or steel, it is up to them to take care of the car. That is A. R. A. rule No. 1 which states what repairs you are to make on the foreign car while on your road. Why return it?

W. J. Stoll: A few years ago you all remember the Master Car Builders put their foot down on running cars under defects. If a defect exists on a car that the delivering line is responsible for, put on a defect card. Rule 2 clearly says that when a car is received by a receiving road with damages and takes its load to its destination, the delivering line must receive the car back.

W. A. Rogers: If in the same physical condition.

G. Lynch (Cleveland, O.): I am puzzled to know what the talk is about. If it is a loaded car offered in bad order in Cleveland, if the owner of the car is in Cleveland we return it to the owner. If it is a foreign car, we return it to the delivering line. If it is a car of melons off any of the southern lines and it is in bad order, we return it to the delivering line when empty. There is no trouble about this thing and I don't know what all the talk is about. It is a case of living up to the rule, as I see it.

W. A. Rogers: We are not talking about a car in the immediate vicinity of interchange. We understand that you can turn a car over to the delivering line or owner, if you have direct connection. We are talking about a car that goes forward without any exceptions being taken, and at the end of perhaps 400 miles it is found with defects. The railroad says it will start it back on a home route record. Are you going to take it with a couple of center sills split? If it was fit to haul a load to its destination, it is fit to

haul a load back. I do not believe in hauling defective cars all over the country; I believe in repairing them.

G. Lynch: The question is not the application of the rule as it is being discussed. If a car moves through interchange O. K., as far as the receiving line's records show, and it returns in a defective condition, after traveling for a week or a month, the delivering line has no right to accept the car. At least they can refuse it. The original receiving line is obliged to take the car back.

M. W. Halbert: The A. R. A. rules are plain enough. I cannot concur in the resolution passed. The rules say you must accept the car under load under certain conditions. It says you must return the car back to the delivering line in its same general condition. Here is the car that Mr. Stoll had reference to with the side posts rotted, the line that delivered the car was duty bound to run the car. Why penalize them simply because they forwarded the car with a load in it? If you try to pin down the delivering line on the bad order equipment you won't get any where. If you take a bad order car under load, with owner's defects, I do not mean defects that originated after the car was received, and when you get one of those old boats that will carry a load to its destination, why penalize the handling line, when you bring it right back; give it to the delivering line and say "Take care of that car." We have a lot of old cars in the St. Louis territory that belong elsewhere and we are trying to get rid of them. We cannot get any railroad to move them unless we pay for the haul or repair. Some of them you cannot repair under A. R. A. prices and make a first class car out of them. The way I look at the resolution, it is going to tie us up. This gentleman says after you get your car it is yours to do what you want to with it, but you are penalizing the fellow who takes it under load with its defects, after he accommodates you by hauling the load to destination and getting rid of the load. Why penalize him because he did not have any record of the car?

W. A. Rogers: It is in the same physical condition.

T. S. Cheadle: I move you that it is the sense of this body that the condition of the car may be established by actual inspection at the time the car was offered back, to determine whether it is in the same condition as received.

F. A. Donahue: Who is the judge?

W. A. Rogers: The receiving road.

RULE 4

The committee recommends that the second paragraph of this rule be modified in accordance with the proposed form shown below:

PROPOSED FORM.—Rule 4, (second paragraph). Defect cards shall not be required for any damage so slight that no repairs are required, nor for raked or cornered sheathing, roof boards, fascia, or bent or cornered end sills, not necessitating the shopping of the car *before reloading.*

A Member: If you receive a car that is damaged and reload it, it is your damage.

T. J. O'Donnell: Suppose we get a Burlington car with 25 sheathing boards missing. The Burlington takes it and makes the delivering line card it; what are you going to do?

F. W. Trapnell: Come back to you.

T. J. O'Donnell: I don't want the delivering road penalized.

F. W. Trapnell: If the Burlington repairs it, the delivering line is responsible.

T. J. O'Donnell: How are we to know what they are going to do? We can simply pass it along if we see it is not cardable without any thought of the afterclap. The refrigerator cars have to be carded.

F. W. Trapnell: And when they get home they always find defects we couldn't see and we always take it up and get the proper protection.

T. J. O'Donnell: Cut out carding unless you feel that the repairs are necessary at the time you card it.

T. S. Cheadle (R. F. & P.): Are the H 1 and H the only convertible freight car valves?

President Gainey: Those are the only ones. Suppose a foreign car when delivered had an H triple in place of a K triple; what would you do with it?

G. Lynch: We wouldn't do anything; let it run.

F. W. Trapnell: Where a non-standard valve is applied to a car that carries a standard valve, should a defect card be issued on the interchange track at the time of the delivery of the car, or, in accordance with our former practice, should it be on the basis of the joint evidence of improper repairs penalizing the party that put the wrong valve on, and not the delivering line? I think that might be on the basis of joint evidence of improper repairs.

G. Lynch: It isn't a cardable defect in interchange. It is a matter for the repair track, the same as wrong repairs; a defect card should be issued and attached to the car at the time the party made the repairs. If the car is coming home to the owner, then I would furnish joint evidence. If it is a foreign car to the receiving line, I would not.

P. J. O'Dea: Isn't it the intention to protect the owners on this high-priced valve, the same as on steel wheels?

G. Lynch: Rule 4 covers wheels, hose, and brake beams. Some lay great stress on the fact that the car is stenciled. We find a similar question in regard to substitution of the 5 by 7 with a 5 by 5 coupler. No one would issue a defect card in interchange. It is the same with the question we are now discussing. It is a cardable defect at the time the repairs are made. On interchange it is not.

President Gainey: I think you are absolutely right. I do not think it is a cardable defect in interchange. If it is a car coming home, it is a joint evidence card you want. If it is a foreign car you do not pay any attention to it.

RULE 32

The committee recommends that Section (d) of Rule 32, be modified in accordance with the form shown below:

PROPOSED FORM.—Rule 32, section (d). Collision, or impact other than that occurring in regular switching, *such as:*

(1) *Misplaced switches.*
(2) *Wrong or misinterpreted signals or failure to observe signals.*
(3) *Letting cars get away on incline.*
(4) *No rider protection when necessary.*
(5) *Coupling on with locomotive at speed exceeding limits of safety.*

The committee recommends that the last paragraph of Rule 32 be modified in accordance with the proposed form shown below:

PROPOSED FORM.—Rule 32 (last paragraph). Defect cards shall not be required for any damage so slight that no repairs are required, nor for raked or cornered sheathing, roofing, fascia, or bent or cornered end sills, *not necessitating* the shopping of the car *before reloading,* the receiving line to be the judge.

T. J. O'Donnell: In discussing this rule Mr. Goodnow said that the committee had given it much thought and this was the best rule they could give. I cannot see any reason why we should not accept this and let it work itself out for a year or so. If you get a car with the sills broken and end all gone, you do your duty when you ask the man on paper how the damage occurred. If he tells you that it occurred in ordinary train service, take this literally.

F. W. Trapnell: Mr. Goodnow, chairman of the Arbitration Committee, gave us to understand that this rule would require more clerical work on the large interchange lines; and you would have to get after the superintendent and trainmaster to give you this information, but we find that the switchman and engineer get into a little trouble and they cover it up. They break a car in two and the switchmen make the statement that it was done in ordinary handling, and the engineer corroborates it. In investigating some of the cases we went to a car foreman and he gave us his side of the story; the trainmaster had no record of damage to the car. It looked peculiar that so much damage would occur to a car in fair usage, so we went up to the engineer and told him what we knew about the case and asked him what he was doing. It developed the fact that the road handling the car was responsible instead of the owner of the car. We have got to get to the bottom of each case and find out that we are not placing repairs on the car owner that should be assumed by the handling line.

G. Lynch: Rule 32 is perhaps impossible of enforcement

on the repair track or interchange track. While I agree with Mr. O'Donnell that it makes it easier for him or me, or any other joint inspector, we could get no information by investigation. We have tried that and the only proof we get is that they don't know. It is a loss of time and impractical to investigate such cases. There are all steel, modern cars that are all shot to pieces. They have not been derailed; consequently the owner is responsible. I have in mind certain private line cars, some have 15-in. center channels with a top and bottom plate, all broken. There is no redress because there is no proof of the car being derailed. The rule, in my opinion, should be rewritten; we might even go back to a combination or limit the damage beyond which the owner would be responsible just so long as we have this go-as-you-please handling of cars that the war brought on with liberal rules, or no rules at all.

T. J. O'Donnell: I want to bring out to offset what Mr. Lynch said that out of 12 cases we had, 5 of them admitted that the delivering line damaged the cars through unfair usage. That is a fair percentage. I cannot help believing that they will be honest enough to admit it. We ought to try the rule out. I think the A. R. A. is going along in a liberal way. We have only had 12 cases in a year. Our officials are very plain. If they have a car in a wreck and send it home they say "We had this in a wreck. Give us a card."

W. J. Stoll: The fact that the handling line is not penalized may not reduce the bad order cars any. My understanding of Rule 32 is that there is supposed to be a more rigid investigation made as to how the damage occurred.

T. J. O'Donnell: You know when you wreck a car and when you don't. When you are in doubt, investigate the case. I do not think we will have any trouble with this rule.

A Member: I don't quite understand the rule. Is there any other damage that could occur in a collision or impact outside of those designated in Articles 1 to 5 inclusive? For instance, switching from both ends of the track or throwing a cut of cars down into another switch would be an impact or a collision, but it is not designated in the five items.

F. A. Donahue (C. & O.): Was not Rule 32 put in force for the express purpose of making the man who had a weak car strengthen it?

C. W. Maddox: The only thing we can do is to use good judgment. I think we can tell whether a car has been damaged in fair usage, and if we find a car looks suspicious we can ask the yard people what information they have. I do not see how we can make any improvement in it.

T. S. Cheadle: We discussed this rule for about three hours last year, and finally somebody said it would have to be left to the man on the job. I am very much of the opinion that we should do the same thing this year.

W. A. Rogers (P. & L. E.): I believe you will have to take a car and if there is any controversy about it the owner will have to take it up with the delivering line.

J. C. Burke (Mo. Pac.): If you get one of your own cars home, how are you going to decide that the damage is done in rough handling?

T. J. O'Donnell: Get it from the operating officials of the road that you delivered from.

J. C. Burke: The delivering line would say, "No rough handling on our line." I take it for granted it would be the same in all cases of this kind. If the evidence isn't there to show that the car has been roughly handled the chief interchange inspector won't be able to decide.

T. J. O'Donnell: He will decide there's no unfair damage and make you do the work.

Rule 43

The committee recommends that the following note be added to rule 43:

Note—In the case of damage to more than five longitudinal sills on wooden underframe cars, more than four longitudinal sills on composite wooden and steel underframe cars, more than three steel longitudinal sills on steel or steel underframe cars and both steel center members on tank cars with two steel longitudinal sills only, the company on whose line such damage occurred must furnish owner statement showing the circumstances under which the damage occurred, if it is claimed that the damage was the result of ordinary handling. This statement, in the case of cars reported under Rule 120, to accompany request for disposition of car, and in cases where it is not necessary to report car under Rule 120 to accompany the bill for repairs.

The committee recommends that, in view of the foregoing note, the first interpretation of Rule 43 shown at the top of page 54 of the 1919 Rules of Interchange. be eliminated.

G. Lynch: Rule 43 is a twin brother of Rule 32. If the Arbitration Committee had stopped at the word, "Only," the rule would be a good rule, but unfortunately they continued on, and spoke of ordinary handling. I take the stand that a steel underframe car of present day construction cannot be damaged to the extent of buckling the sills or breaking them in ordinary handling. I do not know what the definition of the term "Ordinary handling" is, as referred to in this rule. That is something we should get defined. As it is, we do not know what ordinary handling is, and we do not want to report half the damages and hold up the car for an indefinite period. I would recommend, at the proper time, that Rule 43 conclude at the word "Only."

President Gainey: Do you say steel sills cannot be bent under fair usage? You see many a car buckled under fair usage.

G. Lynch: It is the definition of the term that is perplexing. What do they mean by "Ordinary usage"? Or "Fair usage"? My interpretation of both of these sentences would be: Judging from the condition of the car, I would say it was something more than the ordinary that did that damage. That is the only way that I could get a definition of the term. I cannot refuse to accept my own car for repairs, regardless of its condition, but this rule would give me a line on just where the responsibility would be placed. As it is now, we do not know where it is.

W. J. Stoll: In my opinion the rule is all right. If you break five sills you make your report accordingly, and if you break three sills, you make another report. The man who damages the car is to furnish a statement.

W. P. Elliott: When four or five sills are broken and nobody knows it, what is to be done when the car gets to interchange?

W. J. Stoll: The fellow that handles it is supposed to give a statement.

W. P. Elliott: They don't know. These cars are damaged in the middle of the yard.

W. J. Stoll: Cars don't derail automatically.

W. P. Elliott: The damage happens, and the car comes in interchange; I have the car, and am going to repair it. How am I going to give a statement that I don't know is true?

T. J. O'Donnell: You had better call a conference with all of the officials in your district and put that up to them, and tell them that beginning September 1 this rule will be in effect. You must have these statements and closer supervision when damage is done. Appeal to those that you are working with. Show the switchmen the amount of money that it means to your railroad, and that is all that you can do.

J. M. Getzen (Buffalo, N. Y.): I think Mr. Elliott is working under adverse conditions, for the reason that he is obliged to take a foreign car in interchange. If in his own mind he is satisfied that the damage happened in ordinary service he can repair the car. If there is a doubt in his mind he has a right to demand protection from the delivering line.

T. S. Cheadle: The chief joint inspector represents the line that delivered the car, as well as the line that received it. He could, in my opinion, handle that by knowing the exact condition of the car, but where there is no chief joint inspector it seems to me that Mr. Herring is right. The joint man should be in a position to get a statement from the delivering line as to how that damage occurred, before he could put it on to that line.

W. P. Elliott: We are taking a great many cars from other lines; he would have some job.

T. S. Cheadle: He has to handle them with a clerical force. We are not honest with the other fellow if we don't, because if the chief joint inspector passes them out to a place where they have no chief joint inspector he has got to pass it.

W. A. Rogers: Is it the consensus of opinion that a car with such defects as outlined in Rule 43, if offered to the owner, would be accepted as owner's defect, and so passed upon by the chief joint inspector?

A Member: Yes.

W. A. Rogers: If there are no reports coming to the owner he will have to get it. An owner would get the car home with six sills broken; the chief joint inspector is the boss and the owner must accept it. If he would investigate and find that the delivering line damaged the car in switching, without a written statement of some kind, then what?

W. J. Stoll: The only thing we can do is to ask the delivering company or the handling line if they had any wreck or derailment.

T. J. O'Donnell: We have 7 out of the 15 that we demanded.

President Gainey: I agree with Mr. Herring. For example; the Southern delivered a Big Four car home with five or more broken sills, and he cannot specify how the sills were broken, who is responsible?

T. J. O'Donnell: Have you refused to accept it as owner's defect?

President Gainey: It is a penalty put on the delivering line for not saying how that car was damaged. If he can show that that car had six sills broken by dropping it over the hump or shifting a cut of cars, he furnishes the desired information, but in the absence of furnishing any information he takes the responsibility.

W. A. Rogers: You're getting in deep water. There is no evidence of that car being in a derailment. There are six sills broken and that is an owner's defect.

President Gainey: If the B. & O. cannot furnish evidence how these sills were broken it is responsible for the six sills.

A Member: What are you going to do with the car?

Answer: We ask the B. & O. how it happened, and for a card for six broken sills.

W. A. Rogers: Is the chief joint inspector going to issue the defect card on the spot, or wait two months?

President Gainey: He will give you a chance the same as on a joint evidence.

A Member: Suppose the car was damaged between the terminal and the place where the chief joint inspector is located and nobody along the delivering line knows that the defect existed until the chief interchange inspector finds it at the terminal, when it is delivered home and he says it is owner's responsibility; who is responsible if all of the sills are broken?

President Gainey: The delivering line is responsible if there are five or more sills broken if it cannot show how the car was broken.

W. A. Rogers: Are you going to issue defect card?

Answer: Yes.

M. W. Halbert: I think we should live up to the instructions of the Arbitration Committee. There is one thing I don't like and that is the investigation. I think under the volume of business we do in St. Louis it will be difficult.

President Gainey: Suppose a wooden car was delivered from one railroad to another in your territory, with five or more broken sills. If the car was going home, in the absence of the man delivering saying how this damage occurred, what would you do?

M. W. Halbert: I would make a personal investigation, and show my common sense, and if I thought the delivering line was responsible, I would say so. If the car owner, I would say, "Take your medicine." You have got to make a decision. There are no two of us going to interpret the rules the same way. We have got to interpret them according to the defect on the car. That is the only way I see that we can get by. We might make a mistake once in a while, but I think the majority of times you will do right.

President Gainey: If a car was delivered home by a connecting line with five or more broken sills and the delivering line could not furnish the evidence, who will be responsible?

G. Lynch: The owner.

President Gainey: Why do you say that? The rule says that the road breaking those five or more sills must furnish you the evidence.

G. Lynch: I would ship the car to the home line and if the delivering line that damaged the car failed to make a report to the owner, the owner would pay. I have no report to make of the car to the owner or to the delivering line.

President Gainey: You passed the car, who's going to be responsible?

G. Lynch: The car owner; there's no evidence of derailment or side-swiping. I don't see any other way out of it.

J. C. Burke: If the owner has received his car home, and the inspector called to make an inspection and there are six sills broken and he knows that it is damaged from one of the five causes, under Rule 32 would he issue a defect card?

G. Lynch: Yes, if I knew that that car was damaged by any of the five items, even if it had a broken coupler, if I knew personally how the damage occurred, no investigation is necessary.

Thereupon the meeting was adjourned until Wednesday morning.

Wednesday Morning Session

President Gainey: Is there any further discussion under Rule 43?

T. S. Cheadle: I think it is a question whether a defect card can be issued under Rule 43. Can the line receiving the car demand a defect card under the rule as written for more than three sills without any indication or cornering or side swiping? At interchange points where there is no chief inspector, if a car comes home with five or more broken sills, would a defect card have to be issued?

T. J. O'Donnell: The receiving line naturally would look for protection, and I think time could elapse to find out how the damage occurred. I think the handling line would protect the owners in their own way, or arrange with the receiving line to take it home.

W. R. McMunn (N. Y. C.): The idea with some chief inspectors at interchange is that it will delay the car seriously in taking the matter up where we have questions as to how the cars were damaged, although in our district we have very little trouble. It is either a case of giving a card, or taking it up with the delivering line, to find out how the car was damaged. Out of 15 cases we gave cards for about 7; the rest were all owner's defects.

T. J. O'Donnell: I do not think that our higher officials want to be drastic against any equipment of that nature. The idea is this: The managements of these railroads in the last 10 years have spent millions to put their equipment in such condition that it will stand the severe handling that the motive power causes at this time. Is it fair for you to pay $3,500 for a good 40 or 50-ton car and then permit somebody in another section of the country to pay $1,200 for a wooden underframe car to go all over the United States and Canada and protect him on the service that that car is obliged to take with a heavy steel underframe car? If his car does not stand the ordinary service it is his duty as owner to bear any expense unless the car is derailed. It is a just rule and I think we ought to sustain it in its entirety. The big trunk lines of this country have spent millions of dollars to keep the equipment up to standard. If some see fit to maintain

a lower class of car, they should be perfectly willing to maintain it by the roads billing them for any expense to handle it. When the sills are broken in ordinary handling I think the owner ought to stand for it.

For that reason I move you that it is the sense of this body that Rule 43 be interpreted on the following basis: The handling line, in breaking the number of sills mentioned, if they see fit to repair the car before delivery, must furnish a statement to the owner when they render a bill for the items mentioned, as to how the damage occurred. If they deliver a car in interchange it is their duty to apply a defect card for unfair handling under the rules, and if not unfair handling, they must issue a statement to the receiving line, if it sees fit to repair the car and bill the owner.

G. Lynch: The motion reads that the defect card shall be issued at interchange and then the statement afterwards. That is contrary to the rule. The statement must come first and then the responsibility afterwards. The motion is wrong to that extent as I see it. It is a rule that is impossible of proper interpretation.

The question was put upon the motion and was carried, with but one dissenting vote.

RULE 108

PROPOSED FORM.—Rule 108. No labor to be charged for the inspection of cars, testing or adjusting brakes, adjusting angle cocks, tightening unions, *nuts or lag screws* or spreading cotters; sill steps, ladder treads or handholds, tightening or straightening on car; *brake shafts or uncoupling levers straightened when not removed from car.*

No charge to be made for the material or labor of lubrication, except as provided in Rule 66.

T. S. Cheadle: In regard to nuts tightened, in case draft bolts are loose and timbers down, and the bolts are tightened, are you entitled to charge?

President Gainey: If you make the card read "tightening draft bolt" you are. I would like to ask Mr. Stone on that question which is proper.

C. C. Stone (Southern): A charge against the owner would not be proper for tightening draft bolts. Rule 107 starts off and says "Labor charge shown unless otherwise specified." Rule 108 specifies no labor charge for tightening nuts. You cannot tighten a bolt unless you tighten the nuts.

T. S. Cheadle: It is undoubtedly a just charge to tighten up draft timber. It often requires considerable work and it is a protection to the owner's car. The rule does not provide for a labor charge for it.

President Gainey: No, but it says "Tightening bolts."

T. S. Cheadle: It appeals to me that it would be a legitimate charge.

President Gainey: It says "Tightening bolts 3/10 of an hour." You cannot tighten a bolt without tightening the nut, and if you tighten 8 or 10 draft bolts on a car, I claim you are entitled to a charge according to Supplement 3.

Mr. Barton (B. & O.): It all depends on the manner in which you make out the repair card. If you put on the repair card that you tightened the draft timbers, I think you will get away with it without argument.

Restenciling G. E. T. Cars

W. M. Herring (Southern): I want to ask with reference to restenciling G. E. T. cars as to what charge has been made. Of course the instructions specify that the charge will be in accordance with the A. R. A. rule, but I wondered if anybody had kept account of the actual cost. I had the matter up with Mr. McManamy to see if we couldn't increase the present amount on account of it being inadequate.

Mr. Barton: We kept account but after taking it up we found they were going to stand strictly to the rule.

W. M. Herring: Mr. McManamy said if we could justify it, he was willing to make it right; that he had heard of several roads making the same request. There was only three or four out of a hundred that asked for an increase in price.

President Gainey: Are you all charging in accordance with the rules and have any of you taken it up with the government to increase that charge?

W. M. Herring: It costs us around $3.50 and I asked if it could be put on the basis of time for reweighing.

President Gainey: Where you get the car out in the yard, you have to send the painter out there or put the car in and you cannot do it for the price, unless you take it for reweighing and restenciling, and then you can get pretty close to it.

W. M. Herring: Mr. McManamy said they had to comply with A. R. A. rules and he couldn't see why we couldn't restencil a car within the limits allowed on Rule 160. I told him that the nature of the work was different from stenciling a car to preserve its identity. I promised to give him something more definite as a reason. Of course it is a bill against the owner of the car, and they in turn bill the administration.

Maintaining Equipment Standards on Cars

T. J. O'Donnell: I would like to ask if the members are having any trouble on carding for a non-steel wheel under a car stenciled "Steel wheels." We are issuing a large number of cards and we feel that it is an injustice. The cars go through different interchange points and we are careful on the Canadian lines. We have to watch cars closely to comply with the instructions of the Canadian line officials. We receive any number of cars with no card on them. We always take the reading of the cast wheels so we will have the data. We are daily carding cars for steel and steel tired wheels. We find that the defect cards apparently have been removed that have been on the car. We also find when we card these cars against the delivering line that the mechanical department has traced and found that the car was carded prior to coming to our territory. The cards are removed by some one. We have sometimes blamed our inspectors, thinking perhaps they do not know what they mean; they would sooner tear it off than take the reading of it.

G. Lynch: Our experience in regard to that matter is that the repairing line refuses to put the card on the car at the time the repairs are made. We seldom see a card on a car at the time of interchange, and we are obliged to issue a defect card. That is in keeping with just what Rule 112 will be. No man will put a defect card on for damage. He isn't putting on a card for wrong repairs that he knows positively he made. The time to put a defect card on is when the repairs are made, not when offered in interchange. We have returned to several of the roads defect cards that were issued in error. Sometimes there is no stencil on a car; originally the car may have been stenciled "Wrought steel wheels" but the owner fails to maintain the stencils. We will have cars offered in interchange with other wrong repairs such as triple valves and no defect card is applied. This is also where the motion in regard to Rule 43 failed. I would ask a man when he makes wrong repairs to put a defect card on the car; that is the cure for the wrong repairs.

President Gainey: The rules bear Mr. O'Donnell out in what he is doing. They say it is a cardable defect in interchange. If a car is stenciled "Steel wheels" and it has a cast wheel, it is his duty to issue a card.

W. J. Stoll: Under government control defect cards were not issued, and there were a good many cars equipped with cast wheels that are now coming to the front and we have to card them.

J. E. Vittum: We have a great deal of trouble because of cars which were stenciled and equipped with steel wheels, but due to rust and corrosion the stencil has been eliminated, and we cannot tell by the reading of the stencil whether steel wheels are standard. Some of the roads are refusing, without the stencil, to issue a defect card because the rule specifically says if the car is so stenciled. I would like to know what the roads are doing, whether they generally are refusing to issue defect cards, although well aware that steel wheels are standard to that equipment.

President Gainey: I think the rule is a good one the way it stands. If a railroad spends the money to put steel wheels under a car instead of cast wheels, it should be protected. We have inspectors on all interchange points, and of late years they have had very little carding to do, and that rule should be lived up to strictly. There is no good reason why an inspector should fail to see a cast wheel in place of steel.

A. Berg: Often cars are away so long that they lose their identity. The stencil and everything else is gone. The owner has no opportunity to maintain it. In view of the fact that this condition exists and we have been penalizing on account of the failure of the party that damaged the wheel to comply with the rules, it behooves the interchange inspector to afford protection.

J. M. Getzen: I want to go back to Rule 88. In our district we are receiving home a large number of cars bearing defect cards reading: "One pair of wood draft timbers in place of metal draft arms, labor only." It isn't my understanding that that rule is intended to deprive the owner of charging for labor and material on such repairs when he gets the car back. I would consider such repairs as temporary. The defect card is wrong, in having that item "Labor only."

F. W. Trapnell: If he considered that as temporary repairs and secured a defect card for labor only, he got more than he was entitled to, because it is my opinion that all he would be entitled to there would be the scrap value of the material that was lost. There is a case in the arbitration decisions between the St. Louis-San Francisco and C. B. & Q. When I offered to make settlement for temporary repairs to give them the scrap value of the material that was removed from the car and settle the case, they thought I was wrong. We took it to the Arbitration Committee and they said if it was temporary repairs, all that the Frisco would be entitled to would be the scrap value of the material, and that was draft arms and metal draft bolster.

J. M. Getzen: What I wanted to bring out was, when you place a defect card on a car it is natural to assume that you bill for those repairs. If you have done that you must be billed for the wood parts and expect to get paid only the labor of substituting.

T. J. O'Donnell: Suppose you bill out wooden draft timbers at a point where you have no metal in stock. My idea is that you should charge for your wood and labor. When the owner comes back he should simply charge for his metal draft arms and the changes. We have a right to put in the wood in place of metal, where we haven't the proper material.

A Member: In that case the defect card should read for material.

J. M. Getzen: It is wrong repairs if you are going to bill it. If we are taking away 500 or 600 lb. of steel, it is wrong repairs.

A Member: This rule protects you when these parts are missing and you issue a defect card for the material, but I do not think there is any defect card due you for labor.

President Gainey: Draft arms that extend 30 in. beyond the body bolster cost $150 or $200 a car. We put in wooden draft timbers and send the car home. The owner is undoubtedly entitled to pay for the draft arms that have cost him $100. I should think the proper way would be to card the car "one set of wooden draft timbers in place of steel."

W. M. Herring: We have had a number of cars come in with wooden timbers and as yet I have been unable to find out in any case by whom they were applied. I have received no bill. I have traced the movement of the cars, and the roads say they have no record of having made the repairs. We have also had cars destroyed on foreign lines, and when we sent a statement showing the depreciated value of the car we showed metal draft arms in accordance with our record. The line having the car in its possession at the time of destruction showed that the car was equipped with wooden draft timbers and wanted us to change our statement. We have had the same thing on metal body bolsters. I could find no arbitration decision to cover that. The only way out I can see is to submit it to the Arbitration Committee for a ruling, as to whether a line destroying a car could settle in accordance with the standard, or according to the condition at the time it was destroyed. It does not seem right to penalize the line destroying the car by charging for a metal arm or body bolster when the car was not so equipped; still the owner should get some protection. On all the cars destroyed during federal control, we have received no protection. We have not found a defect card on any of the cars that came home with wrong repairs, either for material or labor, and when we have traced the car back, we have been unable to find out by whom the repairs were made.

W. M. Herring: I think he should be protected on material. Rule 95 will give him that authority.

P. F. Spangler (St. L.-S. F.): The rules set forth the specific items of material which you are required to carry in stock. If you do not have the material in stock and substitute wrong material instead, you are responsible to the owner for the labor and material. If, to expedite repairs, you substitute wooden parts, all you are liable for is the labor and you should attach your card to the car. I often throw away a body bolster and substitute wood, attaching a defect card for the labor only, allowing scrap credit for the bolster removed and bill for the labor and material of the wooden bolster applied. Rule 122 is plain on that.

T. S. Cheadle: Rule 16 says that the original construction of the car must be maintained. If you replace a wrong draft arm in place of the right one, you would only be entitled to the labor. These parts that we have to carry in stock are regular A. R. A. material. I understand it has been done, but it was not the intention to permit you to put wood in place of metal and only pay for the labor.

(At this point the discussion on the Rules of Interchange was closed. The papers presented at the later sessions will be published in the next issue.)

CARS BUILT THIS YEAR.—Statistics regarding the number of freight and passenger cars delivered to the railways of the United States by 23 car building companies during the first seven months of 1920, show that these amounted to 21,000 freight cars and 49 passenger cars. This indicates that 1920 is likely to furnish a new low record for car production. The number of cars on order and undelivered increased steadily since the first of the year, until at the end of July the orders amounted to 50,275 freight cars and 811 passenger cars, the increase being obviously due to the fact that the builders were receiving orders faster than they were turning cars out.

NEW YORK CENTRAL MOTION PICTURE, "BULLETIN 70".—Marcus A. Dow, general safety agent of the New York Central, has brought out a fourth motion picture for use in giving safety lessons to the employees of the road. Unlike "The House That Jack Built" and other films heretofore produced for the New York Central, the present one deals mainly with the startling facts of the railroad accident records of the whole country.

The title of this film is "Bulletin 70," and the story is based on the annual statistical accident report of the Interstate Commerce Commission for the calendar year 1918, which was contained in the bulletin of that number. That record tells of 9,286 persons killed and 174,575 injured on the railroads of the United States in the twelve months, and the details and classifications of casualties fill 30 large pages—not to mention $40,000,000 in money damages. Mr. Dow has been able, of course, only to touch a few of the "high spots" of the record.

A New Method of Case Hardening Steel*

Former Methods Are Compared With a New Process of Case Hardening by Regenerated Cyanogen Gas

BY WM. J. MERTEN

Metallurgical Engineer, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

IRON and low carbon steels absorb carbon from so-called carburizers very readily when in contact with these carbonaceous materials at temperatures above the upper critical point. The quantity of carbon absorbed depends upon several factors. One of these is the temperature or degree of heat above the critical point of the steel. In other words, the higher the temperature, the faster and deeper the penetration of the carbon.

The character of the carburizer is also an important factor in the successful conductance of case hardening including the depth of the case. Elementary carbon as such is only of secondary importance. Oxygen and nitrogen compounds which are added or are naturally present in the so-called energizers are necessary to generate nascent gaseous carburizing mixtures of carbon monoxide and cyanogen gas (CO and CN).

The percentage of carbon present in the steel used for case hardening has also a marked influence upon the affinity of the material for more carbon up to saturation; more specifically, a low carbon steel absorbs faster than high carbon steels.

The presence of chromium, tungsten, or manganese accelerates the absorption of carbon since they form double carbides with the iron. Nickel and silicon, however, retard the absorption. The fact that they form solid solutions with iron may be the cause for this retardation.

From statements made in the second paragraph it is readily conceivable that, if a properly heated piece of steel be brought into contact with pure nascent gas continuously generated in a separate unit or chamber and preferably under pressure, the conditions for case penetration would approach the ideal. A process of this type is the one presented in this paper, preceded by a survey of the processes now in vogue with their disadvantages and deficiencies.

Present-Day Methods of Case Hardening

The most general and commonly used method of case hardening is conducted by packing steel parts in a metal box filled with carburizing materials and firing the tightly closed box and contents at a sufficiently high temperature for an adequate length of time to give the desired depth of case. This process is quite simple and assures fair success if properly conducted in accordance with a prescribed procedure, experimentally determined to give certain definite results under definite and specific conditions.

The disadvantages of the above process are as follows: (1) uncertainty of proper reaction within closed box; (2) difficulty in duplication of results as predetermined, because of non-uniformity of carburizers; (3) long time exposure of the steel to a heat not well controllable, producing a questionable structural condition; (4) high cost of operation because of inefficiency of the heating method; (5) cost of boxes due to rapid deterioration of same by oxidation.

The second method to be mentioned is case hardening by immersing the steel article in a cyanide bath heated to about 860 deg. C. (1580 deg. F.). This process is convenient and effective on small articles only and where the depth of the required case is not more than .005 in. to .015 in., or where mere surface hardening is wanted. This is a fast case-forming method and from 10 to 15 minutes gives the desired depth. The outstanding disadvantage of this process is that no uniform case can be produced. The parts deep in the melted bath do not get the same depth of penetration as the parts near the surface. The evolution of the cyanide gases at or near the surface favors the penetration and it is hardly feasible to have pots with a large enough surface area to take care of the case hardening of a plant.

The third method consists of dipping a cherry red piece of steel or tool into a container of powdered cyanide salt, such as potassium cyanide, sodium cyanide, ferro and ferri cyanides, or sprinkling the powdered salt of these cyanides on the red hot steel surface and putting the steel back into the fire again. The case hardening produced in this way is very superficial. In the fourth method the carburizing gases are passed over a piece of steel heated in a retort. This process is applicable to parts that are intricate in design.

The process to be discussed next, although still in the experimental stage, owing to radical changes in the principle employed, appears to present opportunities for efficiency, preservation of the product, simplicity of operation, uniformity of results, speed of operation, reasonable cost, and wide range of utility. This process may be called a regenerated cyanogen gas case hardening.

Cyanogen Gas Case Hardening

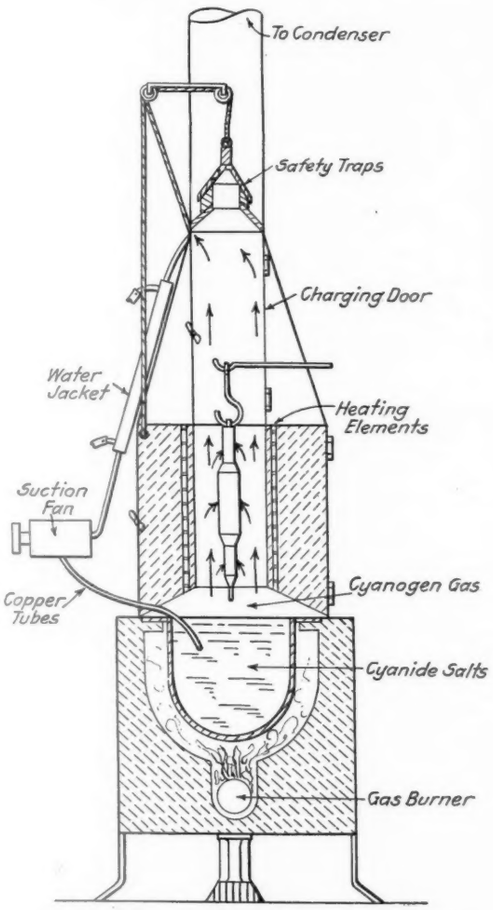
It has long been recognized that the most efficient carburizing gas is cyanogen (CN). The case is of a greater

*Paper read September 9, 1920, before the Pittsburgh Chapter of the Steel Treating Research Society.

uniformity, is more rapidly produced and penetrates deeper than one produced by carbon monoxide (CO), but the highly poisonous character of the substance has been a serious objection to its use. The tendency is to wastefully lead the gas to the stack and out of harm's way, instead of controlling it to get maximum efficiency.

To case harden steel and iron alloy articles in a stream of cyanogen gas evolved from a container filled with an alkali cyanide salt, heated by electrical energy or other means to accomplish vaporization or boiling of the salt, is the principle upon which this process is based.

The articles or materials to be processed are independently heated out of contact with the fused cyanide salt. The advantage of this will readily be appreciated on recalling the statements made regarding the fact that case hardening is produced by contact with gaseous and not with solid carbon



Regenerative Gas Case Hardening Furnace

and more especially with cyanogen gas. The depth of penetration is then only a function of the uniformity of the temperature of the article treated and the duration of treatment. Nascent cyanogen gas has a speed of penetration of four or five times that of carbon monoxide.

The furnace shown in the sketch embodies the regenerative principle since the excess gases not absorbed by the steel are forced under pressure into the fused cyanide (CN) bath, are reheated, causing a vigorous stirring of the bath, and a lively evolution of cyanogen gas, leaving with more energy and larger quantities, therefore more vigorously attacking the steel surface, causing accelerated and deeper penetration.

This regenerative type of furnace is a means to use the rather expensive salt economically, as the nitrogen gas on returning will combine with the sodium and a carbon supply in some cheap form such as charcoal can be added to the liquid as required, thereby retaining the original supply of cyanide salt intact.

To prevent the poisonous gases from escaping into the room, the suction fan indicated is shut down before the charging door is opened and a bell ventilating device for inducing draft is arranged so as to open the bell when the fan stops and prior to opening the door.

Parts of the pump or suction fan should be of non-ferrous metals such as copper, basic alloys or hard copper. Water cooling jackets or other protective methods are to be employed for the return flues for hot gases and the nozzle end of the flue must be of hard copper, monel metal or other non-ferrous alloy with a high melting point.

Sodium cyanide melts at 600 deg. C. (1112 deg. F.) and boils at 800 deg. C. (1472 deg. F.). The temperature of the pot must therefore be not less than 800 deg. C. and to effectively absorb this gas the steel is at a temperature above the critical point or about 900 deg. C. (1650 deg. F.).

The furnace illustrated in sketch is a design for the processing of shafts, etc., but a slight modification of the upper or steel heating chamber will adapt it to a variety of work. Grates of nichrome metal with knife edge supports are used.

The advantages of this process are the following: (1) temperature control is more perfect since the pyrometer is inserted directly in the heating chamber; (2) a finer, more uniform, and deeper case can be secured than by any other processes and less time is required; (3) the use and storage of carburizers and carburizing boxes is eliminated.

It should be noted that while some of the less important features of this process are still speculative in character, because of the experimental stage of the development, the method is based upon well known principles and the conclusions have been drawn from a careful study of general case hardening practice.

CARBON AND HIGH SPEED STEEL*

BY J. J. RYAN
Baltimore & Ohio

The forging of tool steel has received less attention than annealing or hardening. Nearly every smith has had more or less experience, but those who forge tool steel as it should be done are scarce. Most smiths think all that is necessary is to forge the article to proper shape and size. They pay little attention to the heat so long as the steel does not fly to pieces.

Occasionally tools are forged at too low a temperature, which is nearly as bad as overheating. Tools forged at too low a temperature will be very brittle, and internal strains are produced which are very liable to crack or spring the tool in hardening. I have seen many smiths who overheat the steel and then hammer it long after all traces of red heat have disappeared. Hammering steel at black heat should not be done under any circumstances.

To properly forge tool steel, have a clean fire deep enough so that the blast will not strike the steel. Keep the steel slightly covered, heat slowly and evenly and turn it over frequently. For a large tool or forging, several heats are required, but it should be finished at a dark red. When the red disappears it is time to stop hammering. When finishing a tool, several heavy blows are necessary to make the steel compact and fine grained.

Good cold chisels, like good steel workers, are scarce. They are the most abused tools in the world. Cold chisels should be made of steel containing from 70 to 80 points carbon. First cut off enough steel to make it the desired length. Heat it to a bright red back about three inches; then trim off the corners on two parallel sides so that the end will have a short, blunt point. This will keep the edges

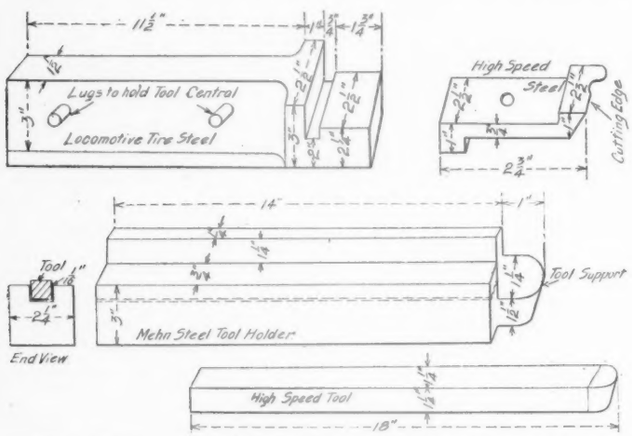
*From a paper read before the International Railroad Master Blacksmiths' Association.

from lapping over in forging. Draw the chisel on the horn of the anvil the first heat and it will not require as much hammering on the edges to get it into the proper shape. The less a chisel is hammered on the edge the better it will be. When it has been hammered on the sides until it is a dark red never turn it up edgeways and strike it. If it must be hammered on the edge put it back in the fire and heat it again, do all the hammering on the edge that is necessary and then hammer it evenly and thoroughly on the sides, but do not strike the edges again. When you get the chisel nearly to size and shape, medium heavy blows are necessary to pack the steel. This should be done when the steel is a very dark red, but when the red disappears, stop hammering immediately. Put the chisel in the fire but do not turn on any blast. As soon as it is a dark red take it out and give it several good blows on each side, then heat again and hammer as before. Repeat the operation three or four times but remember to keep your hammer off the edges. If the chisel gets too wide or the edges get crooked, it can be filed or ground to shape.

In making a flat chisel out of ¾-in. steel, draw it out so that it will be about ⅛ in. thick at the end, and about ¼ in. thick three inches from the end. A chisel of this size should be about ⅞ in. or ¾ in. wide and a trifle thicker in the center than it is at the edges.

When the chisel is forged, let it cool off and grind it. When it is ready to harden, heat it to an even dark red back as far as it has been drawn. Plunge it in the bath straight down as far as it is hot enough to harden; move it up and down slightly but not sideways. As soon as the chisel is cooled through take it out and rub one side bright and then hold it over the fire, and drawing it evenly to a regular cold chisel blue.

A chisel made in this way can be worn back three inches before it needs dressing and the edge will stand far better than the ordinary chisel made like a blunt wedge and hardened about ¼ in. on the end, as it is generally done.



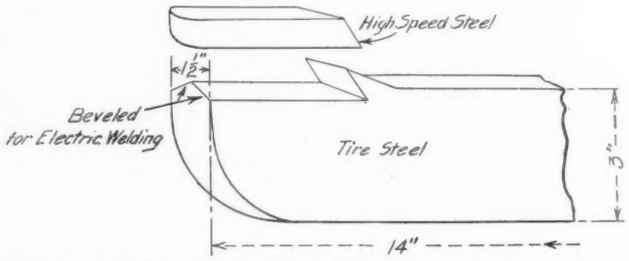
Two Types of Tire Steel Wheel Lathe Tools with Inserted Cutting Blades

This method of forging steel holds good on all flat tools and tools that can be finished on the flat sides, such as side tools, flat drills, cut-off tools, etc.

BY R. W. MILLER
Baltimore & Ohio

We are compelled to be specific in stating what each round, square or octagon bar of tool steel is to be used for. We have about three grades of carbon tool steel that vary from 90 points to 150 points carbon and one high speed steel. This is standardizing as far as it is possible and when we have a furnace for heat treatment of tools equipped with a pyrometer to gage the heat, the tool question is reduced to a science. One man should be placed in entire charge.

None of our car wheel and locomotive lathe tools are of solid high speed steel shanks, as they are forged from tire steel and tipped with high speed steel by electric welding. I have experimented very extensively in welding high speed tips to tire steel and find that the best way is to electric weld them. In using solid high speed steel, after the largest tool becomes too short it is drawn down to the next size that will make the tool long enough without any waste, and so on down until the last operation will produce a piece ⅜ in. by ⅜ in., 2½ in or 3 in. long, to be used in one of our own make tool holders. We save all the cuttings and trimmings, which are reclaimed at the Mt. Clare shops, Baltimore, Md. I know of no other process with less waste. In one year's accumulation we have about 25 lbs. of high speed steel scrap, which is sent to the Mt. Clare shops.



Method of Applying High Speed Steel Tips to Tire Lathe Tools by Electric Welding

All our large taps and reamers are also made from scrap pieces of high speed steel. The bodies of these reamers are made of soft steel, case hardened, and the cutting blades inserted.

All high speed steel is annealed by placing the steel so that the pieces will not come in contact with each other, in a filling of two-thirds iron borings and about one-third charcoal. This is placed in an oil furnace, brought up to a good heat and left in the furnace to cool as the furnace cools down, about 10 or 12 hours, after which the box is taken out of the furnace and kept in a dry place for about five hours before opening. The box for holding this material is a 12-in. or 14-in. pipe about 18 in. or more in length with a plug in each end and a ⅝-in. rod passing through the box from end to end to hold the plugs in position. The plugs are tapered to draw up tight.

In hardening high speed steel parts a furnace is used for large pieces and a forge, bricked up to retain the heat is used for small pieces. The parts are quenched in linseed oil, moved up and down, not in a circle. The ⅜-in. by ⅞-in. by 12-in. blades warp a little but are forced into their seats in the reamer and are peened with a hammer to make a good fit. A collar at the top end of the reamer keeps the blades from being forced upward in using the reamer.

Our large tire lathes are equipped with tire steel holders of the type shown in the drawing, with inserted high speed steel cutting parts. We have taken cuts 1¼ in. wide and 7/16 in. thick with these tools.

Discussion

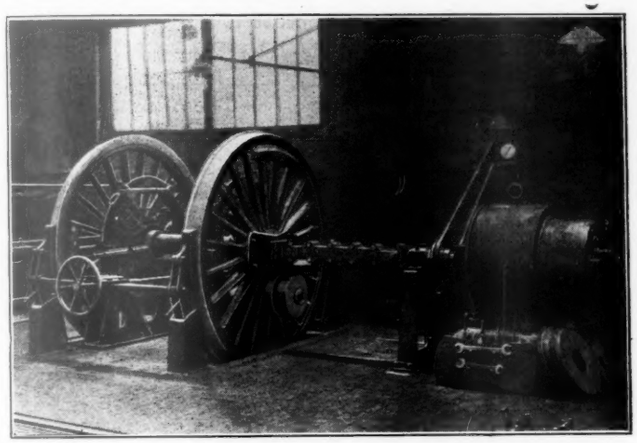
The suitability of open hearth carbon steel for tools was discussed by a number of the members who have had experience with it, the consensus of opinion being that this material is not suitable for tools and that crucible steel should be used.

The methods of forging tools described in Mr. Ryan's paper were generally conceded to be excellent, but a number of the members took exception to them as being too slow to satisfy the demand for output which must be met in railroad shops. A number of instances were mentioned where chisels are dressed under small belt driven hammers which make it possible for one man to dress several hundred chisels in an eight-hour day.

LOCOMOTIVE WHEEL BALANCING MACHINE

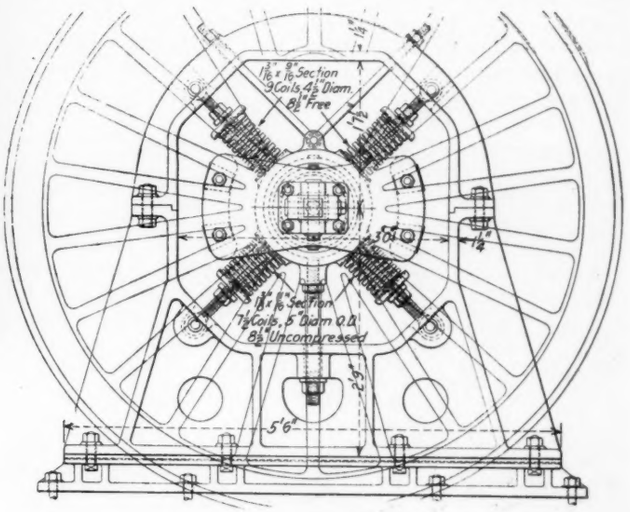
Device Used in British Railroad Shops Tests Wheels by Rotating Them in Spring Supported Bearings

IN American railroad shops little attention is generally given to accurate balancing of locomotive driving wheels. Improper balance increases the stress on the rail and on the machinery and causes bad riding qualities. For that reason it seems that the matter should receive more attention. The greater refinement in this respect that is practiced on British railroads is exemplified by a machine for balancing locomotive driving wheels designed by G. J. Churchward, of the Great Western Railway, and described in The Engineer. This machine was first installed at the Swindon shops of the Great Western and since that time has been put in use at Crewe on the London & North Western, and Doncaster on the Great Northern. In commenting on the use of the machine The Engineer states that while the theory underlying the balancing of locomotive wheels is well developed, a locomotive wheel that has been balanced purely by calculation is seldom if ever completely free from the action of unbalanced centrifugal forces when running. The results secured with this machine have demonstrated that all locomotive wheels, however carefully the balancing calculations have been conducted, should be subsequently examined experimentally and adjusted in accordance with the condition shown.



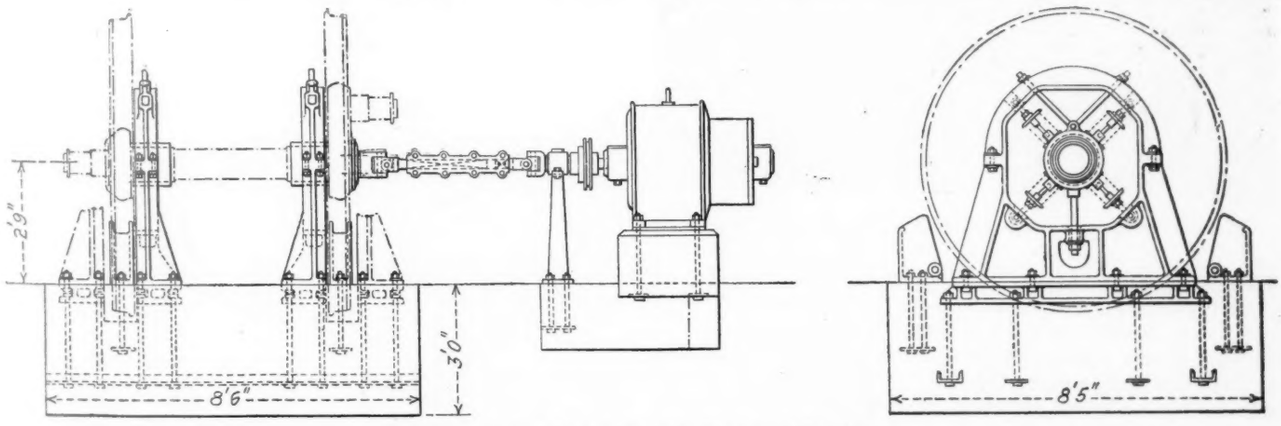
Balancing Machine Showing Driving Motor and Flexible Shaft

The machine consists of a pair of bearings for the axle, each bearing being supported on four springs so arranged that the bearings may "float" and vibrate with the axle, should the wheels when spun be out of strict balance. As will be gathered from the accompanying illustrations, the bearings and their springs are supported from cast iron frames split horizontally to permit the wheels to be inserted and bolted to the foundations in a manner permitting the distance between the frames to be adjusted to suit wheels with inside or outside bearings. The spring bearings of the machines are also split horizontally, and can accommodate brasses of different internal diameter to suit axle journals of various sizes. The brasses are bedded not directly against the cast iron external straps of the spring bearings, but against spherically backed brasses with which these straps are lined. Thus any faulty alinement of the bearing brasses or any tendency for them to get out of alinement by a possible whipping of the axle or similar movement can be accommodated.



Details of the Floating Bearing

The upper and lower halves of the cast iron straps carrying the bearings are tied by bolts to the upper and lower halves respectively of the surrounding cast iron frames.



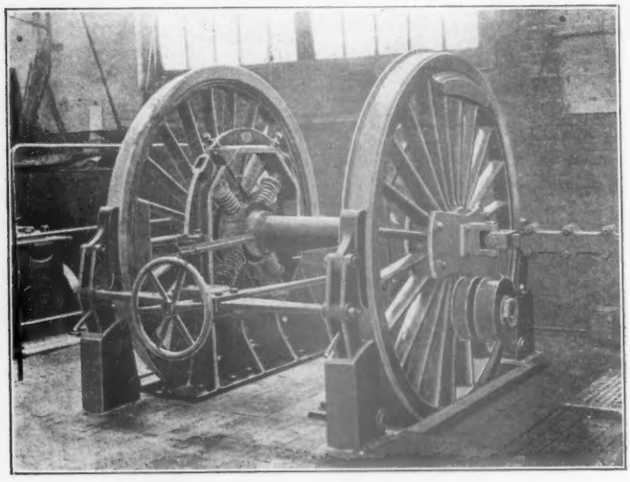
Arrangement of Motor, Flexible Shaft and Bearings

These ties, however, are quite loose and are intended merely to limit the extent of the vibrating action without interfering with the early stages of its development. The weight of the wheels and the unbalanced centrifugal forces, if such forces exist, are transmitted to the surrounding frames entirely through the springs.

The wheels are driven by a 35-hp. electric motor, the driving connection being established through an extensible shaft, having a Hooke's joint at each end. The final portion of the Hooke's joint next the wheel is bolted to a plate, which in turn is bolted to the spokes of the wheel. The center line of the driving shaft must, of course, at the outset be accurately collinear with the center line of the axle in order to avoid introducing an extraneous source of vibration. To facilitate the attainment of this condition when the wheels are being set up in the machine, the final portion of the Hooke's joint next the wheel is provided with a spring plunger in the form of a lathe center, and the driving plate is bolted to the wheel spokes with this plunger entered into the center mark on the axle end. A tachometer driven off the motor shaft permits the speed, in miles per hour at which vibration begins, to be noted.

Brake equipment, comprising two brake blocks per wheel, is provided in order that the wheels may be quickly brought to rest at the end of a run. The brakes may be applied either by means of a hand wheel or by admitting air at 90-lb. pressure to a standard 8-in. cylinder.

Before a test is made the small portions of the axle journals projecting clear of the spring bearing brasses are smeared with red lead, and the point of a spring plunger marker—clearly shown in one of the illustrations—is brought within a short distance of each smeared surface. These markers when vibration begins, scrape away the red lead lying



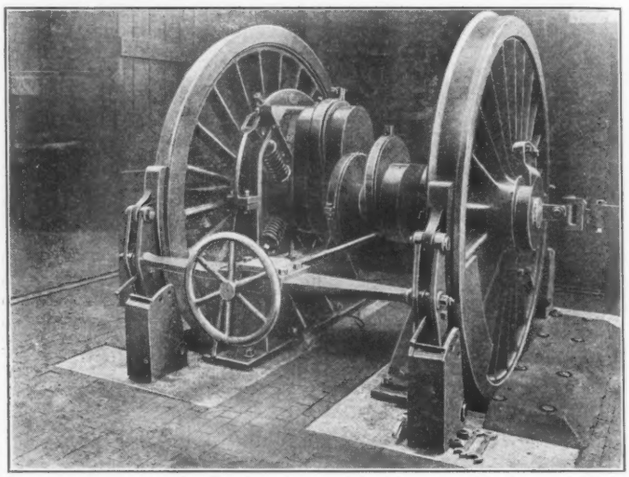
Balance Weights Applied to Wheels with Outside Cranks

towards the radius of the wheel along which the unbalanced centrifugal force is developed.

It is the common practice in Great Britain to take the revolving masses plus two-thirds of the reciprocating masses, and to regard the sum as the total revolving mass to be balanced. For each type of wheel the calculated amount of the revolving and reciprocating masses to be balanced is represented by a weight or weights attached to the crank pins, the weights in the case of an inside cylinder engine being split and held to the crank pins by means of straps. To secure correct results it is important that the weights representing the portion of the reciprocating masses to be balanced should revolve in the plane in which these masses reciprocate. In the case of coupled wheels, therefore, temporary extension pieces are attached to the crank pins, so that the weights representing the reciprocating masses may be brought out into the plane of the connecting rod, crosshead, piston, etc.

In balancing wheels they are speeded up until they begin to vibrate and are then brought to rest, and a trial weight is bolted to the spokes at a point indicated by the mark on the axle. They are then again brought up to speed, corrections in the counterweight being made until they are in complete balance up to and at the maximum speed. When the correct weight has been found a draftsman determines from its magnitude and position the additional weight which must be added to the wheel to secure proper balance.

To facilitate changes in counterbalances they are cast with pockets or formed from steel plates riveted on each side of the spoke with lead poured in between. The lead is alloyed with antimony, which causes it to expand on cooling and



Balancing Machine with Wheels for an Inside Cylinder Engine

avoids the trouble experienced due to the counterweight pounding to pieces when pure lead is used. It is interesting to note that when a pair of wheels for an inside cylinder engine was run in the machine distinct signs were noted that the crank axle was "breathing" under the action of the centrifugal forces on the balance weights in the wheels. As a result the practice had been adopted of building up such axles with balanced cranks and applying the balance weights entirely to the crank webs and not to the wheels.

Apprenticeship in France.—As a means of providing for the present shortage of skilled labor in France, a law has been promulgated providing for the creation of technical classes for youths under the age of eighteen employed in works and factories. Employers themselves have the right to establish classes for their hands, but where this is not done the classes must be instituted by the chambers of commerce or by professional groups with funds provided partly by the state. There is a general feeling that the state should not be permitted to monopolize the instruction, and employers are, therefore, urged to provide the instruction themselves as part of the technical training of their hands.

Improvement in Screw Measuring Machines.—Dr. P. E. Shaw, of University College, Nottingham, England, has improved a screw-measuring machine, which appears to be simple in construction and rapid in operation. All the movements are sliding, thus greatly reducing the time needed for measuring. One special merit claimed for the new machine is that it is equally applicable to plug and ring screws. There appears no reason to doubt that this claim is correct, in which case a distinct advance in meteorology will have been secured. The accuracy of the new machine is stated to be to 1-5,000th of an inch on diameters, and 1-20,000th on pitches, both in the case of plug and ring screws.—*Scientific American.*

LABOR-SAVING DEVICES ON THE SANTA FE

Aggregate Savings Due to the Adoption of Apparently Simple Shop Kinks Often Are of Great Importance

BY J. ROBERT PHELPS

Apprentice Instructor, Atchison, Topeka & Santa Fe, San Bernardino, Cal.

EFFICIENT shop devices that have worked out well in actual practice in the San Bernadino Shops of the Atchison, Topeka & Santa Fe are shown in the accompanying illustrations and described below.

Clamps Used on Tire Boring Mill

In boring the largest tires for passenger locomotives, it was found a difficult task to clamp them to the boring mill

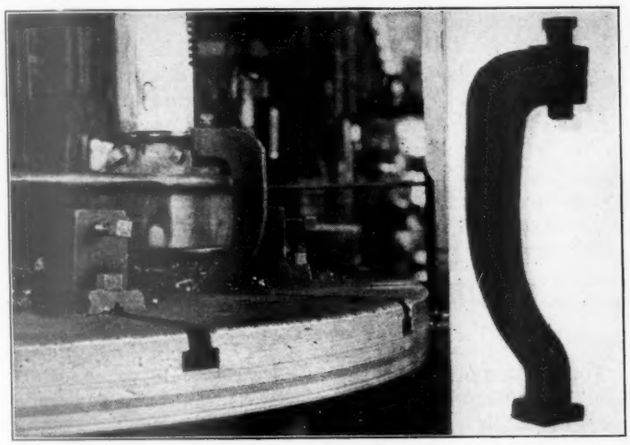


Fig. 1—Clamp for Holding Tires on Boring Mill Table

table owing to their large size. Before making the clamps, shown in Fig. 1, bolts and blocks were used, requiring considerable time for the set-up and not holding the tires firmly. To obviate this difficulty, special clamps were forged with T-heads to fit the slots in the boring mill table, the clamps

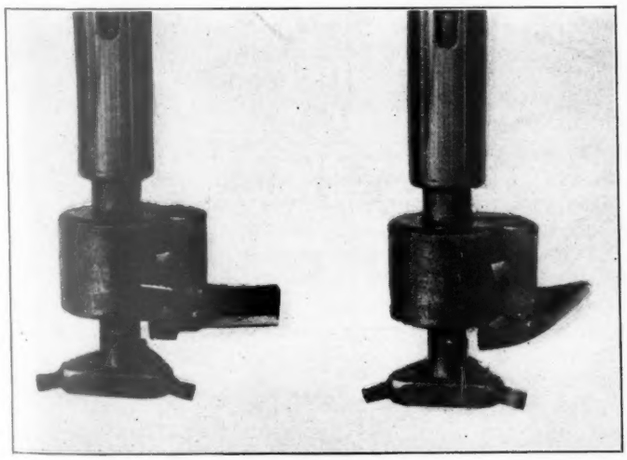


Fig. 2—Jigs for Machining Steam Pipe Joints

being offset to pass around the tire and having set screws for tightening the tire to the table. In setting up on these screws, all the pull comes directly on the tire which is held firmly to the table by six clamps, or as many as may be necessary.

Facing Steam Pipe Joints

At one time in railroad shop practice it was thought advisable to make up all steam and exhaust pipe joints using white lead. Under the action of high temperature steam over a considerable period of time, this white lead acted on the joints to make them very rough. The result was that they often required machining before being ground in and this work was formerly done at San Bernardino on a horizontal boring bar, already overcrowded with work.

To relieve the boring bar of this work, the tool illustrated in Fig. 2 was designed and the machine operation

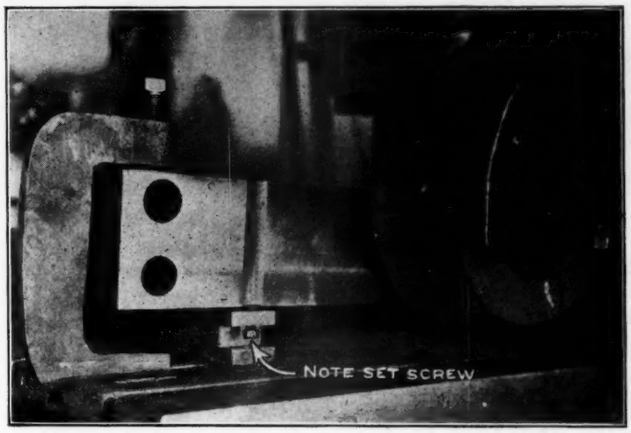


Fig. 3—View Showing Use of Guide Adjusting Block

can now be performed on a radial drill press. As indicated, the tool consists of cutters suitable for flat seats or ball joints, the cutter in either case being guided by a spider or pilot block adjusted to any desired position by the use of set screws. In operation, the spider is set in the steam pipe

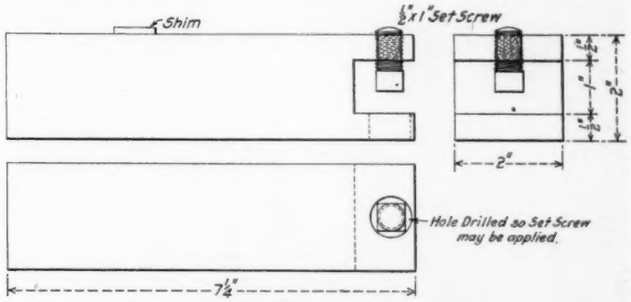


Fig. 4—Details of Guide Adjusting Block

which is firmly clamped to the base of the radial drill. The drill is started and, guided by the spider, the cutter forms a joint quickly and accurately.

Guide Adjusting Blocks

The actual operation of grinding a slightly worn guide takes from 5 to 10 min., while from 20 to 30 min. is often used, tipping the guide one way or the other to get it in position, so the wheel will grind square. The jig, illustrated

in Fig. 3, was designed to reduce this time to the minimum and make it unnecessary to bother with paper shims. By use of the set-screws shown, the guide can be tipped to any designed angle without stopping the machine or loosening up clamps.

Construction details of the jig are shown in Fig. 4. A bar of iron or soft steel, 2 in. square by 7 or 8 in. long, has a slot milled in one end and a hole drilled and tapped to take the ½ in. by 1 in. set-screw shown. In order to permit

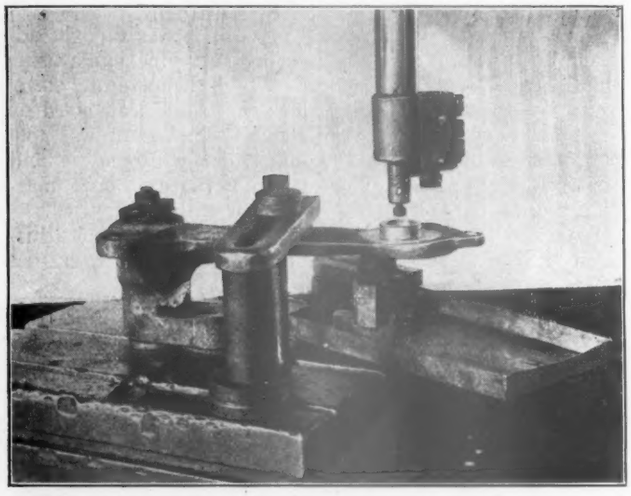


Fig. 5—Tool for Forming Brake Hanger Boss

tipping the guide towards the wheel, the thin shim indicated is provided and may be attached to the jig by electric welding if desired. The arrangement has proved a great time-saver.

Machining Brake Hanger Bosses

A device for holding and a tool for machining brake hanger bosses on all classes of locomotives is shown in Fig. 5. Formerly this work had to be done on a horizontal boring bar,

Fig. 6—Jig for Machining Reverse Lever Quardants

but under the new arrangement the operation can be performed on a radial drill press. A hole is first drilled in the brake hanger at the proper place, and the succeeding operations of counter boring, turning and facing are all performed in one operation with the tool illustrated. The arrangement of this tool is plainly shown, and a similar one adapted to the particular dimensions of any brake hanger can be provided. The only further operation necessary after facing is tapping the thread. The time now required for all the above operations is 16 minutes, and with an average of 125 brake hangers machined each month, the total saving in time is considerable.

Milling Reverse Lever Quadrants

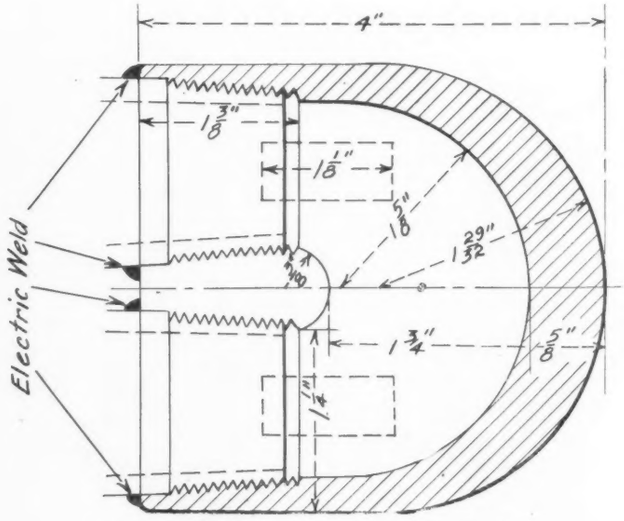
It is common practice in some shops to lay out reverse lever quadrants and later machine the teeth on a shaper or slotting machine. With this method of manufacturing quadrants, considerable time is spent in laying out the teeth, and the work of machining them is both unnecessarily long and non-uniform in results.

To overcome these difficulties the arrangement shown can be used to good advantage. Referring to Fig. 6, the reverse lever quadrant *Q* is supported on the table of the universal milling machine by a quadrant support *A*, being firmly held in place by the set-screw shown. The radius rods *B* are adjusted to the proper length and supported on the extension *C* firmly fastened to the milling machine table. A latch operated by the latch handle *D* is provided at the quadrant support, being arranged to fit into each quadrant tooth, while the next tooth is being milled. The quadrant is thus accurately located for each tooth. By using this arrangement, the radius of the quadrant is correct, every tooth is exactly the same depth, the same distance apart, and all the labor of laying out the radius and teeth on the bench is saved with a resultant decrease in labor cost.

WELDING SUPERHEATER UNITS

BY W. EISELE

The ordinary superheater unit with four tubes and three return bends presents numerous opportunities for leakage, especially in the six threaded connections. Although the return bends are made of high grade steel and the tubes are secured by a taper thread there is considerable



Method of Welding Tubes in Return Bends

trouble from leaky joints. Electric welding where the tube entered the return bend was tried in order to stop the leakage, but it was found after several trials that the weld when cooled and tested was not perfect, due to the unequal expansion of the rolled steel tube and the cast steel return bend. This difficulty has been overcome by filling the unit with water and plugging the open end with wooden plugs while welding. The water reduces the expansion to a minimum and makes it easy to get a tight joint.

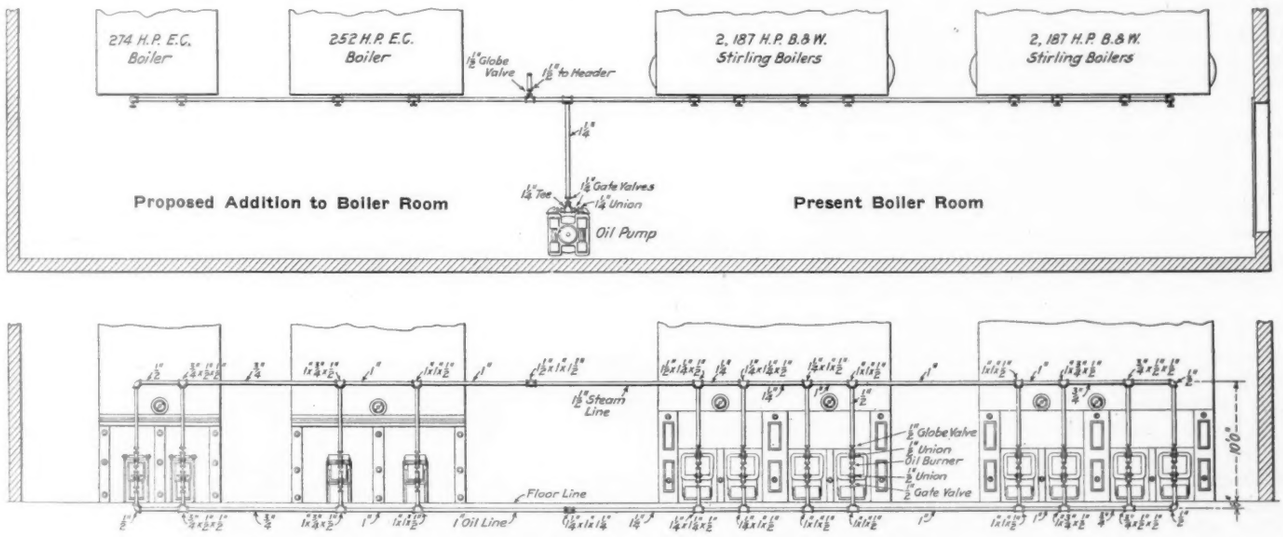
FUEL OIL AS A MEANS TO INCREASED CAPACITY

Critical Boiler Plant Condition Relieved and Efficiency Improved by the Use of Fuel Oil in Place of Coal

BY C. C. LANCE
Shop Engineer, Seaboard Air Line

THE Jacksonville plant of the Seaboard Air Line provides power, light, compressed air, water and fire protection to a general shop for repairing locomotives, freight and passenger cars. It is the second in point of size on this railroad and cares for all repair work originating on the southern end of the line.

In addition to the shop requirements, power, water and compressed air are supplied to a large roundhouse and all locomotives running in and out of this terminal take water here. The roundhouse has a separate stationary boiler to furnish steam for blowing engines and similar purposes, as on account of the distance from the main power plant it was not considered economical to carry steam that far. When originally built the boiler equipment consisted of three 187 hp. Stirling boilers, arranged for burning coal, hand-fired, each boiler having its separate steel stack. An underground ash tunnel was provided below these boilers, which were provided with ash hoppers that dumped into buckets on narrow-gage cars which were so arranged that they could be dumped by an outside overhead electric traveling crane.



Arrangement of Oil Burning Apparatus, Seaboard Air Line, Jacksonville, Fla.

The power generating equipment consisted of two 120 kw. alternating current generators and one 120 kw. direct current generator, each direct connected to tandem compound Erie Ball engines, a 35 kw. direct current steam driven generator and one 35 kw. steam turbine. One 925 cu. ft. steam-driven air compressor and two 500-gal. per minute underwriters' steam fire pumps furnished water supply as well as fire protection. The generating equipment was run condensing with vacuum and dry air pumps, no circulating pump being installed, as the pressure from the artesian well supplying water was sufficient to carry cooling water through the condenser.

Increased Demand for Power

The increase in size and weight of locomotives being handled in the shops and roundhouse and the generally increased demands for all kinds of repair work made it necessary to modernize the shops at Jacksonville and add to the machine tool equipment. This in turn required more power, additional boiler capacity and larger generators. The plant at present consists of four 187 hp. Stirling boilers in two batteries, one 252 hp. and one 274 hp. Erie City vertical water tube boiler set separately. All boilers are connected to a concrete stack 6 ft. 6 in. inside diameter, 175 ft. high, which gives a draft of 1¼-in., while the best obtainable draft with separate stacks was 0.3 in.

Power is now supplied by one 500 kw. turbine-driven alternator, one 120 kw. direct-current and one 120 kw. alternating current generator, each direct connected to tandem compound steam engines. Two 500 and one 1,000-gal. per minute underwriters' steam fire pumps supply water and afford fire protection, while one 925 cu. ft. and one 1,500 cu. ft. steam-driven air compressors supply the compressed air required. The 120 kw. alternating current generator is used for the night operations. The turbine is operated condensing having vacuum, dry air and circulating pumps, the water used being conserved by a concrete spray cooling pond having a capacity of 200,000 gal. located about 500 ft. distant, from whence it is pumped back into the water mains for fire and service purposes. On account of objections raised by the mechanics, a separate water line for drinking purposes supplying water not passing through condenser or reservoir has been put in. Feed water is supplied to boilers through an open type feed water heater, using a battery of regular type feed pumps with duplicate pipe lines and equipment to insure against shut downs.

Critical Situation Relieved by Oil Fuel

Due to the large increase in the cost of coal, the extremely poor quality obtainable and the difficulty in securing and keeping the labor required to fire the three shifts, great difficulty was experienced in making periodical inspections,

washing boilers and making repairs, while keeping the plant in operation. It became necessary to put two locomotives into service as auxiliary steam units, and during repair and washout times as many as three locomotives were in service. At that time there was a total connected load of approximately 1,400 hp. with a boiler plant totaling not over 1,000 hp.

With the separate stacks affording insufficient draft, poor coal and a shortage of labor it became imperative to effect some improvement in the capacity of the boilers. After a study of the situation and a discussion in regard to the probable cost of various means for increasing boiler capacity, it was decided that conversion to oil fuel in place of coal afforded the most practical means at hand. It was estimated that the initial cost of making this change was considerably less than would be required to install additional boilers and that with oil fuel the sustained capacity of the boilers could be greatly increased. However, this step was delayed and the plant continued to burn coal until December, 1919, by which time the frequent shutdowns and other operating difficulties increased until immediate relief became necessary.

Oil Burning Equipment Installed

The facilities installed for burning oil consisted of a 25,000-gal. steel storage tank and a duplicate system of oil piping leading to the pump, heating pipes being provided inside the tank and in each oil pipe line leading to the pump on account of the heavy consistency of the oil used. Each boiler was piped with steam and oil pipes with control valves located conveniently to operator's reach. Tate-Jones burners were used, modified slightly to give improved atomization of the oil and throw a better spray. The only changes made in the boilers were the building of higher bridge walls to protect the bottom drums and tubes, and slight alterations to the baffles, fire brick protections to the grates and the bricking up of all door openings.

The original plans for the oil burning system were made by the mechanical department, and the work of converting the plant from coal to oil burning was most expeditiously handled by the mechanical forces at Jacksonville.

Improvement Effected in Operating Results

Since changing this plant from coal to oil a remarkable increase in efficiency has been made as well as extensive savings in operating cost.

With the peak demand for power at present only four boilers are required to carry the load, and three have handled it successfully. At night three boilers ordinarily carry the total load and occasionally it has been cared for by two. When additional boiler power is required, a boiler can be brought from warm water to steam at working pressure and cut in on the line in 25 minutes from the time that the oil is lighted.

A marked saving has been made on account of the ease with which the oil fuel is handled and delivered to the boilers. The elimination of the ash removal, with its dirt and danger and the use of the overhead traveling crane or keeping a night crane operator on just for this purpose, has released a large force, as well as the men who were formerly required to handle coal and fire the boilers.

A statement showing the comparison of the working force required firing with coal and that required using oil is given.

FORCE REQUIRED FOR COAL BURNING			FORCE REQUIRED FOR OIL BURNING			
No. men	Occupation	Monthly rate	No. men	Occupation	Monthly rate	Monthly savings
	First Shift 7 A. M. to 3 P. M.					
1	Chief engineer	$271.20	1	Chief engin'r	$271.20	
1	Engineer	194.40	1	Engineer	194.40	
1	Oiler	121.20	1	Oiler	121.20	
1	Water tender	121.20	1	Water tender	121.20	
5	Firemen	606.00	1	Fireman	121.20	$484.80
3	Ashmen	285.20				285.20
9	Coal passers	456.00				456.00
1	Cleaner	98.40	1	Cleaner	98.40	
1	Ashman foreman	121.20				121.20
	Second Shift 3 P. M. to 11 P. M.					
1	Engineer	194.40	1	Engineer	194.40	
1	Oiler	121.20	1	Oiler	121.20	
1	Water tender	114.00	1	Water tender	114.00	
4	Firemen	484.80	1	Fireman	121.20	363.60
3	Coal passers	285.20				285.20
1	Craneman (night)	171.20				171.20
1	Ashman	98.40				98.40
	Third Shift 11 P. M. to 7. A. M.					
1	Engineer	194.40	1	Engineer	194.40	
1	Oiler	121.20	1	Oiler	121.20	
1	Water tender	114.00	1	Water tender	114.00	
3	Firemen	363.60	1	Fireman	121.20	242.40
2	Coal passers	196.80				196.80
1	Cleaner	98.40	1	Cleaner	98.40	
	Total labor cost per month	$4,832.40		Total labor cost per month	$2,127.60	
	Total monthly savings				$2,704.80	
	Total labor annual savings				32,457.60	

However, these conditions changed in July and the price of oil advanced to 11½ cents per gal. or an increase of 8½ cents over the original cost. This was subsequently reduced to 6 cents per gal. The consumption of oil was carefully investigated and by better heating and atomization and by changing the draft this was reduced to approximately 178,000 gallons per month, making the present monthly oil cost approximately $10,680.00.

The monthly fuel consumption based on the maximum demand for power is given below comparing oil and coal.

Burning coal (estimated, August, 1920, figures) 2,250 tons @ $6	$13,500.00	
Labor cost	4,832.40	
		$18,332.40
Burning oil August, 1920, figures oil 178,000 gallons @ $0.06	$10,680.00	
Labor cost	2,127.60	
Saving per month in favor of oil		12,807.60
		$5,524.80

or $66,297.60 per annum.

Based on the 100 hours shut down in 1919 mentioned above and the estimated shut down of 4 hours for 1920, the difference in favor of oil fuel will be as follows: Present rates and costs being used).

Monthly oil cost (present) fuel and labor	$12,807.60	
Annual oil cost (present) fuel and labor	153,691.20	
Four hours' time lost per annum on 15 locos. in shop at $166.00 per day, shut downs chargeable to oil	27.64	
Four hours' time @ $75 per annum lost, account mechanics and others not producing account no power, shut downs chargeable to oil	300.00	
Total annual approximate operating costs burning oil		$154,018.84
Monthly coal cost (present demand), fuel and labor	$18,332.40	
Annual coal cost	219,988.80	
One hundred hours' time lost per annum on 15 locos. in shop @ $166 per day, shut downs chargeable to coal	691.00	
One hundred hours' time @ $75 per hour per annum lost account mechanics and others not producing, account no power. Shut downs chargeable to coal	7,500.00	
Total annual approximate operating costs burning coal		$228,179.80
Annual approximate cost burning coal		$228,179.80
Annual approximate cost burning oil		154,018.84
Approximate annual saving in fuel and labor by burning oil		$74,160.96

Reliability and Economy

During 1919 the shut downs on account of bad coal and other difficulties amounted to 100 hours, while in the 5 months ending May 31, 1920, shut downs of only 1 hr. 45 minutes were directly traceable to oil fuel. Based on this, the shut down on account of oil would amount to only 4 hours per annum. During 1919, 15,503 tons of coal were used, costing $5.50 per ton or $85,266.50. For the five months ending May 31, 1920, the total oil consumption was 1,280,631 gallons or an average of 256,124 gallons per month. On this basis the annual oil consumption would be 3,073,488 gallons, which, at $1.25 per bbl., amounts to $92,204.64.

The monthly fuel consumption based on the maximum demand for power is given below comparing oil and coal.

This saving will represent six per cent on the investment of $1,236,016.00, while the total cost of equipping this plant to burn oil did not exceed $5,000.00.

HEAVY BRASS CASTINGS FOR RAILROAD SHOPS

Important Savings are Possible by Operating Brass Foundries in Conjunction with Railroad Shops

BY A FOUNDRY SUPERINTENDENT

HOW many locomotive days are lost annually because of the lack of brass castings, temporarily out of stock? How many miscellaneous break-down jobs could be repaired quickly if some medium for making a brass casting was available? How many tons of scrap brass, sold to an outside foundry, could be converted into brass castings at a nominal cost? The following suggestions and an analysis of the figures quoted show that there is economy in operating a brass foundry on either a large or small scale in conjunction with a railroad shop.

A railroad with 8,000 miles of track buys approximately 900,000 lb. of new driving box and rod brasses, hub plates and other heavy castings annually and sells approximately 725,000 lb. of scrap, this figure being an estimate based on actual facts. In order to arrive at a basis of comparison and compute the possible savings by making brass castings in railroad shop foundries instead of buying them the following data are used. The market price for lake copper, always quoted as a base, is 20 cents a pound. Scrap brass in most localities can be sold for 18 cents a pound. New castings are usually purchased from outside foundries at 28 cents a pound. An annual output of 725,000 lb. per year represents a daily output of about 2,416 lb. and a foundry capable of handling this tonnage would represent an investment of approximately $13,000 in buildings and grounds and $3,000 in equipment. In remelting and casting brass, there is a shrinkage of four per cent and the shrinkage in 725,000 lb. would, therefore, be 21,750 lb. to be replaced by purchase.

TABLE I—COMPARISON OF RELATIVE COSTS

(A)	Cost of buying new castings—	
	Sold—	
	725,000 lb. scrap brass at 18 cents	$130,500
	Purchased—	
	725,000 lb. new castings at 28 cents	203,000
	Net cost	$72,500
(B)	Cost of making new castings—	
	Material—	
	725,000 lb. scrap brass available	
	21,750 lb. at 18 cents to offset shrinkage	$3,915
	Sand, flour, parting, plumbago, etc	5,430
	Labor (including overhead) to convert into castings	9,070
	Interest on investment, insurance, etc	1,120
	Total	$19,535
	Net annual saving of (B) over (A)	$53,965

With a net annual saving of approximately $54,000 shown in Table I, the saving per pound is about 8 cents. The labor charge should not go over two cents a pound but if it went to five cents there would still be an important saving. In support of a charge of two cents a pound for labor it may be stated that one molder in a nine-hour day can turn out eight driving brasses weighing 225 lb. each or a total of 1,800 lb. If the molder is paid $1.00 an hour, this represents a cost of ½ cent a pound for direct labor. Adding ¾ cent a pound overhead and ⅛ cent a pound for shipping, handling, accounting, etc., there is a total of 1½ cents a pound. The writer is now connected with a brass foundry that is manufacturing driving brasses, hub plates, rod brasses, bushings and other heavy castings for locomotive and shop use and does not hesitate to say that, regardless of how small the castings may be, it is a poor molder who can not make them for at least one cent a pound.

Specialties can usually be purchased cheaper than they can be manufactured in railroad shops but heavy brass castings are not in this class of specialties since no extensive equipment is needed for making them. A small brass foundry, located at the principal shop on a division, and having a maximum capacity of 1,200 lb. a day, could be constructed at a small cost as shown in Fig. 1, and costs little to operate, one molder and helper handling the work. Oil is a more satisfactory melting medium than coke and if oil is used at the shop, it could easily be piped to the building and substituted for coke. As heavy casting work will predominate there is no necessity for a sprue cutter. The gates and sprues on the heavy work can be removed with a chipping hammer, which will require running an air line to the foundry. An industrial track in and out of the foundry would make for economy.

If a heavy tonnage is required and oil is available, an open flame furnace of the Rockwell, Monarch or Schwartz type should be used, as these types are capable of heating 500 lb.

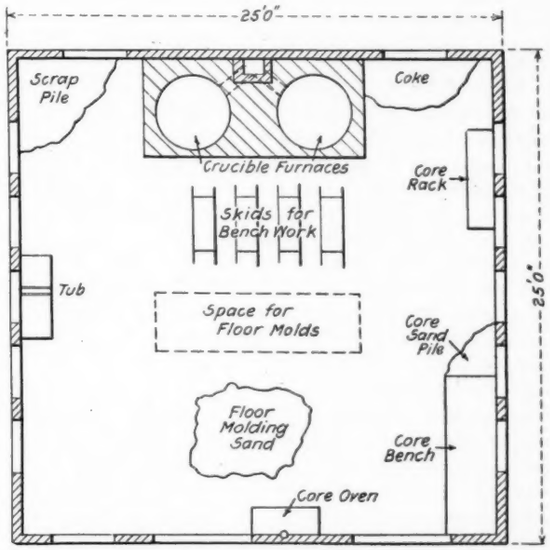


Fig. 1—Plan of Small Brass Foundry With Capacity of 1,200 Lb. a Day

every 65 to 75 min. It has been stated that a good bearing brass cannot be secured if the metal is melted in the open flame type furnace but one of the largest brass foundries in the middle west has used this type of furnace with excellent results.

Proportions of Copper, Tin and Lead

A copper, tin and lead alloy is recognized as the standard bearing bronze and while there is some argument as to the proportions, it is generally agreed that a mixture of 80 per cent copper, 10 per cent tin and 10 per cent lead is the best. The tin and lead will burn off to a slight extent, and if it is desired to maintain the standard mixture, one pound of tin and one pound of lead should be added to each 100 lb. of scrap put into the furnace. Some railroads specify the following mixture: 79 to 81 per cent copper, 9 to 11 per cent tin, 9 to 11 per cent lead, not less than .0025 phosphorus. (In order to maintain .0025 per cent phosphorus, .0075 must be added to the furnace charge on account of

shrinkage.) Phosphorus acts as a flux in the metal and not only cleanses it but changes the structure of molten brass from a creamy consistency to a watery one. One ounce of phosphorus to a ladle will do this. It also changes the color of the molten metal from a light pink to a greenish pink.

While phosphorus is decidedly hard to handle in brass casting work, it, nevertheless, is a great factor in amalgamating the metal, as a casting in which phosphorus is used has a finer grain than one from which it is omitted. The objectionable feature is that the molten phosphorus mixture has a tendency to eat into the sand and make a rough casting but experience teaches ways to overcome this difficulty.

Table II—Equipment Needed for a Foundry with a Maximum Capacity of 1,200 Lb. of Castings a Day

Core Room	
One core bench	Twenty-five core plates
One core oven	
Furnace Room	
Two crucible furnaces with pits complete	One No. 80 to 100 crucible tong
	One No. 80 to 100 crucible shank
One 5 hp. motor	One No. 60 crucible shank
One centrifugal furnace	One coke fork (if coke is used)
One No. 60 crucible tong	
Molding Room	
Four skids on which to place bench molds	Two No. 10 riddles
	Molders' tools, shovels, etc.
One molder's tub	Miscellaneous wooden and iron flasks of sizes to fit work
Two No. 2 riddles	
Two No. 6 riddles	
Cleaning Room	
One air chipping hammer	One air grinder

Directions for Melting and Pouring

If the crucible type furnace is used and the casting to be made weighs in excess of 180 lb., a 240 lb. capacity crucible is needed. The scrap metal should be put in the crucible and brought up to about 1,975 deg. F. This temperature causes a free, liquid content. About 15 minutes before lifting the crucible from the furnace, one pound of tin and one pound of lead should be added. This should be melted down and the heat brought up to 1,975 deg. again. The molten metal must be stirred thoroughly in order to get the lighter metals mixed with the heavier. Lift the crucible out of the furnace and carry it to the pour-off floor. The metal should be poured at about 1,700 deg. F. A lower temperature might result in the metal freezing before the mold is filled up and a higher temperature would cause the metal to eat into the sand, more especially if phosphorus is used.

Should a pyrometer not be available, the pour-off man must rely on his vision to judge the heat. Molten metal at 1,800 deg. F. or more will bubble and present a rough surface. As it cools off the surface of the metal becomes more even and just before reaching 1,700 deg. F., a bubble will appear about the center of the pot and break, spreading over the entire surface and changing the complexion of the metal to a more creamy mass. The metal should be poured immediately after this takes place. Pour a small stream to begin with, gradually increasing the flow until it is all the sprue hole will stand. As the sprue fills up, ease off and at the finish, pour very lightly, filling up the sprue to the top. Shrinkage occurs in the metal almost immediately and it is therefore necessary to keep the sprue well filled. Small brass castings are comparatively simple to make, but a solid, amalgamated driving box brass presents many difficulties. There must be no blow holes, and the copper, tin and lead must be thoroughly mixed with no segregation.

Molding Driving Box Brasses

Equally important with the heating and pouring of metal is the making of the mold. In the first place the proper sand is essential and Albany floor sand is recommended as one of the best. After repeated tests as to position of pattern in the mold, it is generally agreed that the crown should be placed up, which puts the bearing surface down as shown in Fig 2. Regardless of the quality of metal used there is bound to be some slag. This slag will therefore appear in the crown or top of the brass instead of on the wearing surface. Fig. 2 shows the position of the pattern, gate, sprue, etc.

It will be noted that the sprue is heavy while the runners leading from the sprue are light. It is found to be good practice to have considerable weight behind the flowing metal but to choke it down to a finer stream before entering the casting space in the mold.

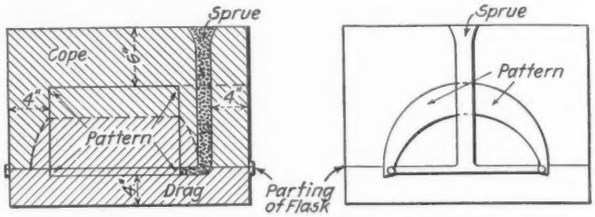


Fig. 2—Proper Method of Casting Driving Box Brass

About four inches of sand should be used on all sides and below the pattern and six inches above. Weights on top of mold will prevent the metal from floating the sand on top. The drag should first be rammed, then the cope. A hand floor rammer should be used, being careful not to strike the pattern with the rammer. Hard ramming adjacent to the pattern and easier away from it will secure the best results. After the cope is rammed and before the pattern is pulled, the cope should be thoroughly vented, using a vent iron about 3/16 in. thick (pointed on the end), being careful not to run the vents up to the pattern.

After opening the mold and removing the patterns, paint the mold with a thick layer of plumbago, using a soft camel's hair brush for this purpose. It is good practice to skin-dry the mold but not essential. Molds should not be allowed to stand over 12 or 14 hours before pouring off. The mold can be dumped in about 1 hour and 30 minutes using a wire brush immediately to remove fins and other irregularities.

There are five important things to remember about brass molding: (1) get the metal thoroughly mixed and pour off at about 1,700 deg. F.; (2) use a first-class floor sand for the mold; (3) use a large sprue; (4) pour slowly at first and then rush the metal; (5) use plumbago profusely. First-class castings can be made in a small foundry and the railroad company will save about 8 cents a pound.

DRILLING RECORDS

Production and penetration records in drilling steel and cast iron were established on October 4 at the American Foundrymen's Association convention, Columbus, Ohio, by Hercules high speed twist drills, made by the Whitman & Barnes Manufacturing Co., Akron, Ohio. The speeds and feeds used in the tests are not advisable for every-day shop use, but indicate the excessive strains that modern drills will withstand. Production records are more valuable than penetration records as showing how many holes can be drilled at one grinding.

Production Records

Material Drilled	Size of Drill	Rev. per Minute	Feed per Rev.	Penetration per Minute	Thickness of Material	Time per Hole	Holes per Grinding
Cast iron....	1 in.	665	.096 in.	63.8 in.	3½ in.	3¼ sec.	61
Cast iron....	1¼ in.	309	.060 in.	18.5 in.	4¼ in.	13¾ sec.	303
Machine steel	2 in.	157	.045 in.	7.1 in.	3 in.	25¼ sec.	28*
Chrome nickel Steel	1 in.	309	.030 in.	9.3 in.	3 in.	19½ sec.	72

*A total of 43 holes were made by this drill on one grinding. First 15 in cast iron 3½ in. thick at 309 r. p. m. with .096 feed, then the above 28 holes in machine steel.

Penetration Records

Material Drilled	Size of Drill	Rev. per Minute	Feed per rev.	Penetration per Minute
Cast iron	⅞ in.	873	.096 in.	83.8 in.
Cast iron	1 in.	873	.096 in.	83.8 in.
Cast iron	2 in.	597	.096 in.	57.3 in.
Machine steel	1 in.	665	.060 in.	39.9 in.
Machine steel	1¼ in.	442	.060 in.	26.5 in.
Machine steel	1½ in.	442	.051 in.	22.5 in.

LOCOMOTIVE SHOP ORGANIZATION AND METHODS*

A Prize Essay on the Best Method of Obtaining the Maximum Output Consistent with Good Work

BY A. F. VIVIAN
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BEFORE it is practicable to consider the method of a repair shop system or any other special factors which make themselves felt in the output of work, it is desirable to outline various general classes of repairs which locomotives may have to undergo. These may be classified as follows:—(1) Minor; (2) light; (3) heavy.

(1) *Minor repairs* are work that lies within the scope of the running shed equipment and staff.

(2) *Light repairs* are work of the nature of re-turning of wheels, lining driving boxes, overhauling motion parts, skimming up piston and valve-rods, examination of boiler, renewal of water-space stays and attention to tubes.

(3) *Heavy repairs* is the class of work where *extensive* repairs are needed to the boiler, wheels, driving boxes, motion work cylinders and steam pipes.

Locomotives needing repairs under classes (2) and (3) only are sent into shops, which is after they have run approximately 40,000 to 80,000 miles.

Output

When these locomotives come to the shops for repairs their out-turn and the progress of the work through the shops depends mainly on the following points:—

(1) Lay-out of works and machinery employed;
(2) Labor; and
(3) Standardization of locomotives.

Layout

The lay-out of the works calls for ingenuity, which only those engaged with the preparation and assembling of locomotive parts can give to the subject. The relation of one department to another as regards proximity and transport of material must have equal consideration with the fixing of plan and machines in the shops themselves, while the timing of each department, so that all may keep in step without either delays or over-production, is very important. No doubling back in the passage of the material through the various processes and machines must be allowed. "In at one door and out at the other" is ever the motto to be kept in mind from the advent of the raw material to the steam trials of the finished locomotives. The pattern shops and wheel-turning department should be located as near the foundries and forge as can be conveniently arranged.

The steel foundry is as necessary an adjunct to a large railway works as an iron foundry—the successful introduction of the small converter having made this step a desirable one in many obvious ways.

The main boiler house and power station must be in a central part of the works for steam, power and light distribution. Wherever possible, individual punching and shearing machines should be motor-driven, and in the bay devoted to machine tools—these may be driven from a main shaft coupled to a wall engine or motor. All heavier punching and shearing machines should be equipped with their own jib cranes. Arrangements for turning out regular quantities of boiler stays by automatic screw machines should be made in the machine shop. Boiler tubes are often stored out of doors, and though the tubes may show no great amount of deterioration undoubtedly they have commenced to rust in spots, and quite likely will have to be removed from the boiler sooner than would have been necessary had they been properly cared for under cover. The life of the tube is shortened; but this is not the only loss, as there is the labor of taking the tubes out and loss of the use of the engine while removing the defective tubes, and this means time lost.

The blacksmith shop should be replete with tools and machines to meet the present-day requirements. Besides Brett steam drop stamps of 30, 20 and 5 cwt. capacity, a few 10-cwt. lifter stamps worked by hand power would be found very useful. The other machines that would be necessary are bolt and nut machines, a couple of Acme riveting and forging machines, one 3-in. Ajax, one Ryder swaging machine, two Bradley hammers, and a couple of double shearing machines.

The work of the spring maker is greatly facilitated by the use of a spring-plate preparing machine. A spring-testing machine would also be found very useful.

The machine shop should consist of complete installation of modern machine tools suitably arranged for proper sequence of work, and it is the expeditious handling of these tools that results in greatly increased output. It is very essential that there should be a well-equipped tool room fenced off from the rest of the shop, devoted to tool manufacture as well as for the making of jigs and jackets for repetition work, the grinding of lathe tools, drills and drilling cutters. All automatic and labor-saving machines should be used for repetition work required in large numbers.

In the erecting shop electric traversers should be used to convey the engines in and out of the shop, and would be in addition to the overhead cranes. A 2-ft tramway on either side of the traverser would be found useful for the conveyance of material to any bay. And as regards the equipment in general, much more attention should be given, as the locomotives of to-day have increased in weight and power and call for different methods of manufacture, and large and more powerful machines are needed to cope with the new requirements.

The stores should be located in a spot convenient to all the shops, as each has dealings with it in some way or other. A branch of the stores department should be assigned to the iron foundry, so that an accurate account may be kept of the output. Articles having thread connections should not be left exposed to the weather, as this renders them almost valueless. Nor should they be roughly handled so that the threads are broken and in many cases the entire article must be scrapped because of bad threads. Rubber hose and all kinds of rubber naturally deteriorate after it has been on hand any great length of time. This should be thoroughly understood by those handling rubber goods, so that sheet rubber and packing and hose which has been on hand longest will be used first, also that proper care may be taken of it, so it is not stored in bright sunlight or in some unusually dry place. Proper housing and storing invariably means reduced cost in handling, and hence less time, besides keeping the material in better condition for use.

The conveyance of material from the stores to the shops, or, from one shop to another, should be done by storage battery trucks, tractors and trailers. It has been estimated that the cost of operating an electric tractor is about equivalent to the daily wage of a trucker. Considering this fact, with the ability of a tractor and a few trailers to do the work

* This article, which appeared recently in the Railway Engineer, was awarded a first prize in a competition. Many of the suggestions which it contains could well be put into practice in American railroad shops.

of six to ten hand trucks, the economy is obvious. These powerful little electric storage machines are made foolproof, and with their use the handling problem is simplified.

The handling of materials.—A factor of great importance is the care of handling material. A great deal of money is lost and time wasted by breakage, leakage and marring of material in various ways, which unfit it for service, a great deal of which could be overcome if the material is properly handled and cared for. Every man having to do with the handling of material should, so far as is possible, be instructed as to the nature of the material, the use to which it is to be put, and the ways in which it may be damaged so that it loses its usefulness entirely, or, at least, injured so that only partial service may be had from it, and even that service is often of the kind that requires a great deal of extra attention. A little rough handling, in most cases entirely unintentional on the part of the man handling the material, causes expense away out of proportion to the value of the article itself, to say nothing of the delay.

Labor

System of work applying to locomotive repairs.—Experience shows that, before any system of despatching or scheduling of work through the shops can be affirmed, there must be, first, a predetermined route, and, second, a predetermined time limit.

With the above in view, the general outline of a working system is hereby made. In order to properly carry it out it is necessary to have a competent schedule man, with authority to check up the system, which is as follows:—

The locomotive is to be thoroughly inspected prior to entering the shops, and the schedule man furnished with a copy of the inspection report, from which the shopping schedule is prepared. Separate forms should then be made out by the schedule man, covering parts to be repaired in various shops, and furnished to each foreman. The first of these forms should show the locomotive number, class, date in and date out of shops, and, under the heading "class of work," various units of the locomotive, condensed into not exceeding 30 items, to be listed in consecutive order in which the parts of the locomotive are dismantled and erected. Space is provided opposite each of these items for the date each particular item is to be dismantled or repairs started, and the date the repairs are to be completed and erected. Space also should be provided opposite each of these items for parts of the locomotive that it is necessary to send to the machine, smith or boiler shops, for the dates these parts should be received in various shops, and the dates they are to be completed. Space also provided opposite each item under the heading of "Remarks," for "The cause of the delay," if any.

The second form, a "Daily schedule delay report" to be furnished by the schedule man to the officers in charge, this form to cover all locomotives in shop in which any part is behind schedule time. Opposite the individual engine numbers space shall be provided for the various units of repairs. Under the heading covering the units of repair, space is to be provided for a check mark to show just what items are behind the schedule and delaying the work, together with the cause.

Oxy-acetylene welding system.—This is a great asset, and a few remarks may not be out of place. The oxy-acetylene cutting process may be used in locomotive shops, both in constructional work and for cutting up old boilers, tanks, etc. In boiler work, manholes, fireholes and mud holes can be cut out of the solid plate, frequently at a cheaper rate than by punching, drilling and slotting. The rapidity with which the oxy-acetylene blowpipe has been taken up by engineers throughout the world is in itself the most striking testimony to its merit, and it is not too much to say that it affords one of the most practical and valuable methods yet discovered for dealing with work in the shops, be it either new or repair. As regards cost, much depends on the nature of the work and the capacity of the workman, but it may be stated generally that the system compares very favorably with the cost of most riveted or brazed work not over ½ in. in thickness.

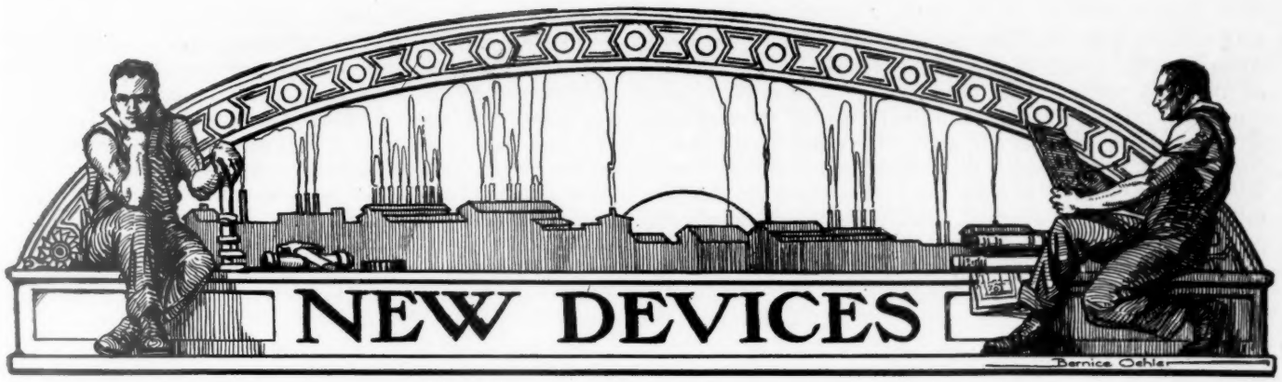
Repetition work in locomotive shops.—One of the lessons learnt from the war is that very great possibilities exist of accurately working to standard dimensions and given limits for component parts. There is undoubtedly a future for development in the design and lay-out of tools for interchangeable and repetition production, and this is a matter which concerns the locomotive as well as other machine shops. Its application will be of a more decided character than heretofore with the standard locomotive looming in the foreground. Reliable and standard limit systems, first for manufacturing, and, secondly, for tools, are necessary to suit modern methods and for all classes of works, and these must be framed from the experience gained in the use of the several existing systems, all of which are far from perfect. Since success depends upon an abundance of special tools and appliances, improved and quicker means must be devised for making them. There is, again, considerable scope for investigation in the methods of hardening high-speed and tool steels without deformation of the metal. One of the greatest manufacturing troubles now experienced is in connection with nickel steel and case-hardened parts, and for repetition work it is more than ever necessary to resort to grinding processes, so that considerable ingenuity must be given to the order in which operations are to be performed between carbonizing and quenching of the part.

Supervision.—The general conclusion is that, to ensure the efficient and economical handling of staff and material, organization is supervision. This, of course, is no new conclusion. It is self-evident. But supervision, to be effective, must be adequate in quantity. The withdrawal of the charge hand or the foreman from his duties several times a day to answer summonses from those in authority, the preparation of reports and routine work, which could be done in much less time by persons with clerical experience, are not conducive to efficient supervision.

Supervision, to be effective, must be respected. This applies to those of higher as well as lower rank. The possession of a proper designation to indicate the character of service rendered, which will command respect from those under this jurisdiction and consideration from those in other departments with whom he comes in contact, is a necessary advantage which should be given to all in charge. Competition for supervising positions should also be encouraged by making such positions as attractive as possible, and, if this is done, it will result in securing the best material available. This is highly essential if proper standards are to be maintained.

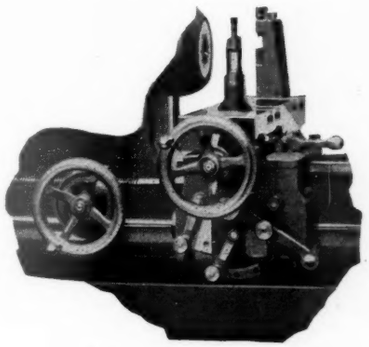
Supervision, to be effective, must also be instructive. The result aimed at is frequently missed because of a lack of understanding. To this cause may be laid many failures both of men and plans. It is necessary, therefore, that instructions should be complete, concise, understandable, and, above all, workable. It is the easiest thing in the world to give orders, but to issue voluminous orders is to ensure their being disregarded.

As regards machine shop progress in locomotive works, it may be said that, with proper supervision and the elimination of obsolete machinery, it should be possible to reduce the size of many locomotive works considerably. It is by no means unusual to find half a dozen bulky machine tools of an out-of-date description engaged in performing work which could be more easily and more economically turned out by modern tools, while at the same time reducing the amount of labor required. The principal aim is, however, that of seeking improvements by virtue of better and more widespread supervision, so that the best use can be made of every man and every machine tool and by the employment of a system which keeps a continuous and careful watch over all that is going on within the shop.

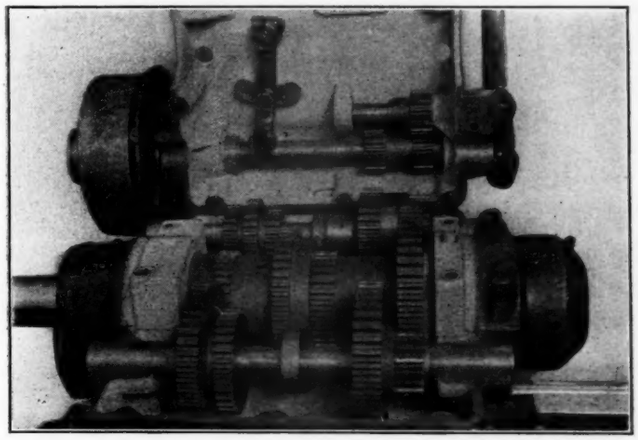


Turret Lathe of Wide Power and Speed Range

THE turret lathe, illustrated, has been developed by the Warner & Swasey Company, Cleveland, Ohio, to satisfy the demands for a machine with greater power and a range of feeds and speeds sufficient to embrace those necessary for machining the many different metals in use today; also those feeds and speeds suitable for facing, forming and cutting off operations on all diameters within the capacity of the machine. The machines have been thoroughly tested under conditions ordinarily encountered in shops and are said to have proved especially valuable in machining alloy steel gear blanks, long drilling operations in the solid, taking heavy facing and forming cuts, and other work which often occurs in railway machine shop practice.

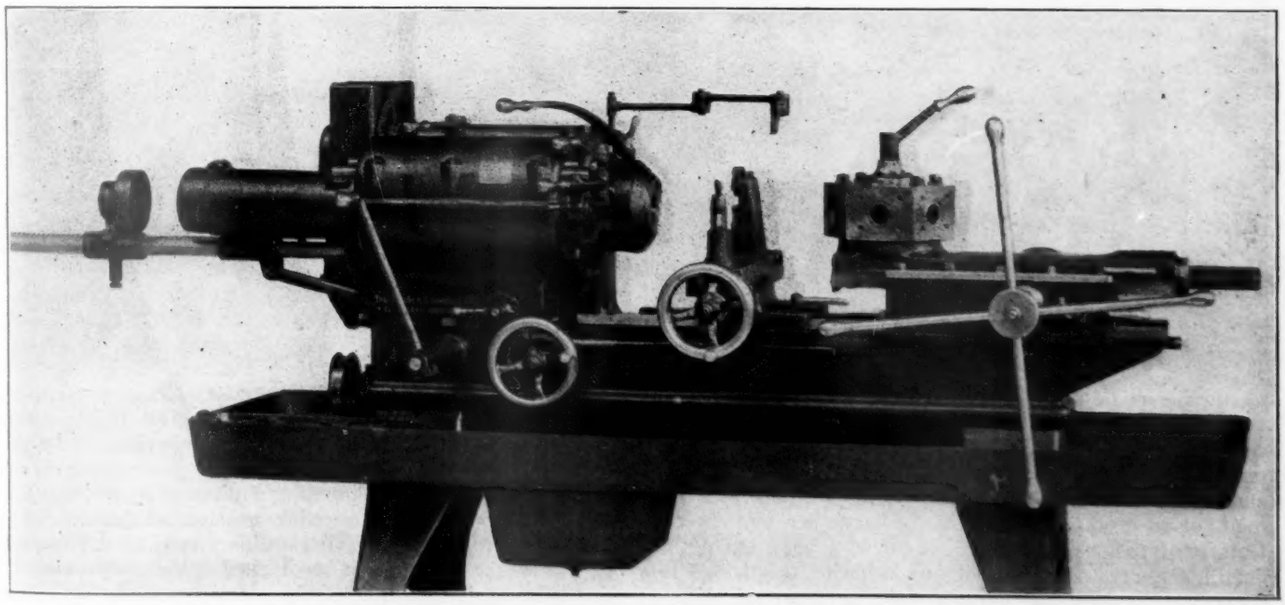


Heavy Duty Carriage



View Showing Arrangement of Gears in Head

One of the most interesting features of the new turret lathe, is the specially constructed geared head. This head consists of steel gears of coarse pitch and wide face, run-



Warner & Swasey No. 6 Geared Head Turret Lathe With Standard Cutoff

ning in oil. Two gear sets are mounted on the front shaft, while the third set and the reverse friction clutch are mounted on the back shaft. This construction is reported to give four times the power of the ordinary geared friction head of the same size machine and double the power of the double friction back geared type. With all of this increased power, less effort is required to move the controlling levers and the machine is easier to operate. The oil bath which oils the gears also lubricates the bearings.

Twelve spindle speeds and reverse are secured by the construction of the geared head which makes possible the use of the particular speed on any one job that will give the best result. It is believed that this turret lathe offers a sufficiently large number of different feeds and speeds to provide flexibility and afford the correct feed and speed for any ordinary machine operation. Another advantage of the geared head construction illustrated is its adaptability to various types of motor drive, including motor drive by means of gears, chain, or belt drive with an idler to the driving shaft.

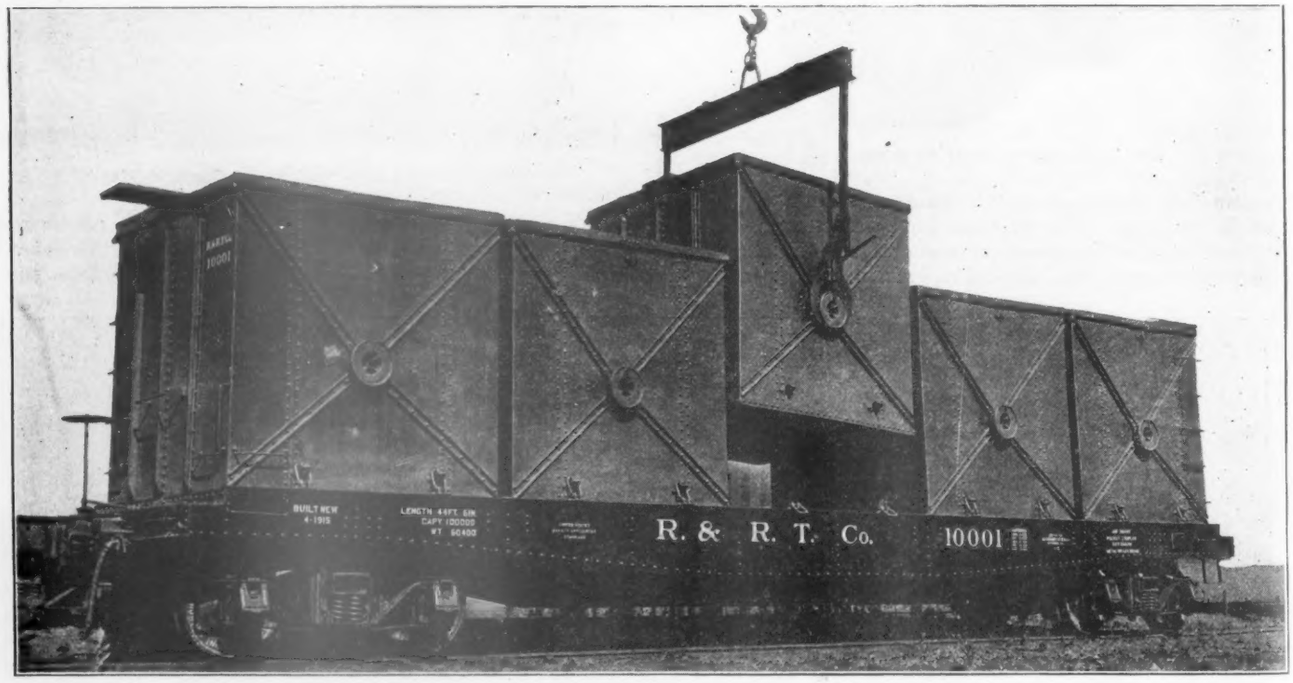
The turret lathe can be furnished with a standard type cutoff or with a new heavy duty carriage valuable for taking heavy cuts and in heavy forming operations. The range of six power cross feeds provides for all ordinary facing, forming and cutting-off feeds. The gears in the feed box controlling the carriage, as well as in the carriage apron, are of special steel designed to withstand all ordinary stress without breaking or undue wear. If desired, a square turret to carry four cutters may be substituted for the front tool post. The turrets are the same as ordinarily furnished with Warner & Swasey turret lathes and can be equipped with power feed, having four changes.

The new turret lathe is made in two sizes, the No. 4 having a capacity to take round bar stock up to 1½ in. in diameter. The swing over the bed is 16 in., over the cross slide 7 in., and the possible length that may be turned is 10 in. The No. 6 turret lathe has a capacity to take round bar stock up to 3¼ in. in diameter with a turned length of 12 in. The swing over the bed is 20⅜ in. and the swing over the cross slide is 9¼ in.

The Unit Freight Handling System

THE Trinity Freight Unit—an interchangeable metal container—designed to carry freight and partially to facilitate its transfer, has been developed by the River and Rail Transportation Company, St. Louis, Missouri. These containers are made in a number of different ways for carrying various kinds of material; with side opening doors for package freight, with top doors and drop bottom for loose bulk freight, and tanks for carrying liquids. They are designed so that merchandise may be placed in a container at a manufacturing plant, or in a warehouse, the container locked and sealed, and then transported by motor truck to a railroad, or to a waterway, where the container and its contents are transferred to a flat car, or to a boat, without rehandling the material and without incurring the risk of loss so frequently resulting through theft or from the damage occurring in the more ordinary methods of handling freight.

The units are made in capacities of 2½ tons and 10 tons each and are proportioned so that five 10-ton units, or twenty 2½ ton units, or several units of both capacities, and for any of the different classes of freight can be carried on a flat car of 50 tons capacity. They are rectangular in form and are substantially constructed of steel plate rigidly reinforced with angle irons to withstand the strains due to the weight of the contents and the transferring of the unit from one vehicle to another.



Trinity Freight Units—Loose Bulk-Freight Type—on a 50-Ton Capacity Unit-System Flat Car. Method of Handling at Large Terminals

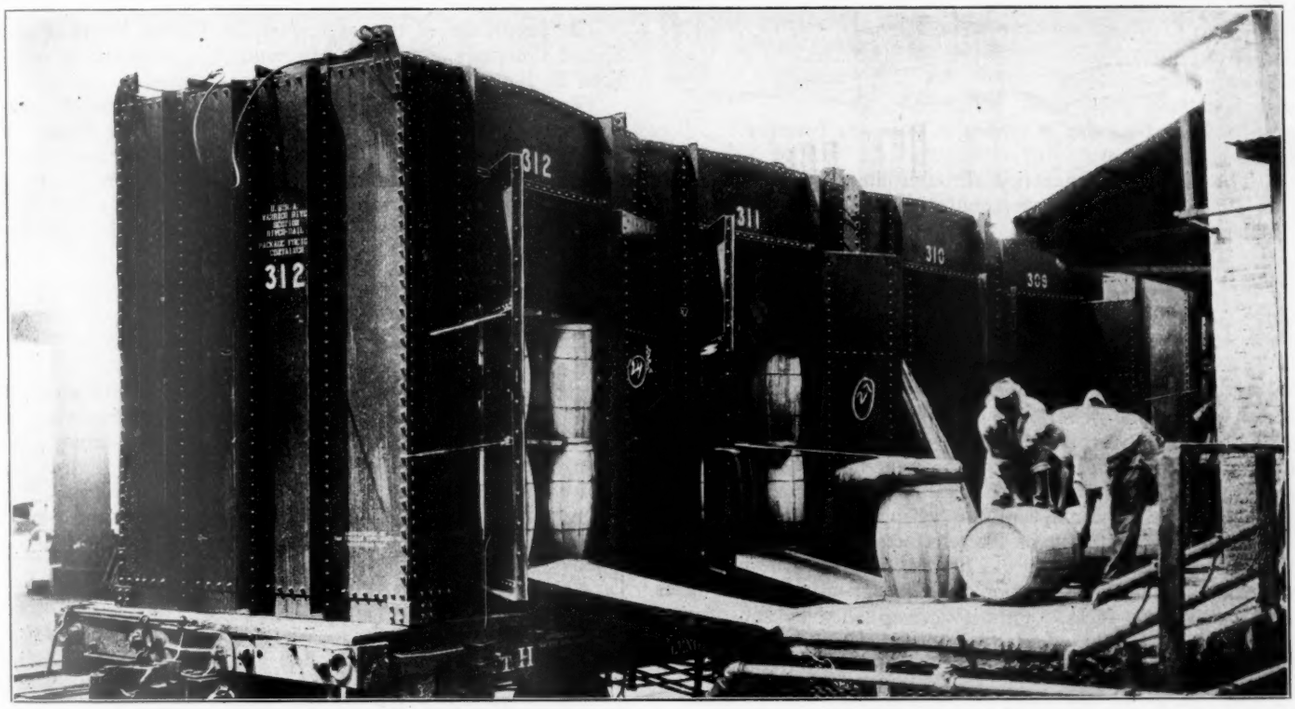
The complete freight handling equipment as developed by this company includes a specially constructed flat car. This car, however, differs from the ordinary type of flat car now in use on the railroads of the United States only in having provision made for clamping the containers to the car so that

they will withstand the shocks incident to train movement. These special cars may be constructed at practically the same cost as any other type of flat car. At a small cost, any flat car built in the usual way may be altered so that the containers can be secured to it, or in an emergency they can be secured by using side stakes.

Those containers designed for package freight are provided with side opening doors on two sides through which they are loaded or unloaded. This type of container is fitted with steel cables, attached to lugs at the top corners, by means of which it is lifted and placed on, or taken off of, the truck, car, or boat. To lift the entire unit a crane, derrick, or other lifting device is required and such equipment generally is installed in large freight houses, or yards, and at terminals. When such equipment is not available a portable crane of the motor truck type may be used. Therefore it is generally possible to handle the loaded container, but when, at small manufacturing plants, or at outlying freight houses, this can not be done, due to lack of facilities, the car on which the containers are placed may be run alongside a platform and the freight loaded in the same manner as in an ordinary box car.

The United States Railroad Administration adopted this system to facilitate water-rail shipment of war supplies. Twenty of the 10-ton package units were built and are said to have given very satisfactory service in the New Orleans district in handling package freight.

In later improved designs containers for handling loose bulk materials were equipped with ladders, handholds and running boards in the same manner as a box car. This type of container is constructed with top doors, through which the freight is loaded, and sometimes, with drop bottom doors for discharging the load. It may be loaded by hand or by means of an automatic bucket, or by other devices for handling loose materials. After loading the container the doors are closed—and locked if desired—and the entire load lifted by means of specially designed lifting links suspended from a spreader bar. These links engage in slotted trunnions on the sides of the container, keeping it in an upright position by means of a latch on the links. When the container is in the desired location the link latch can be released and the container overturned, or the drop bottom doors released—when the container is of that type—and the load discharged.



Trinity Freight Units—Package-Freight Type—on an Ordinary Flat Car. Method of Loading at a Small Station Where No Handling Equipment Is Available

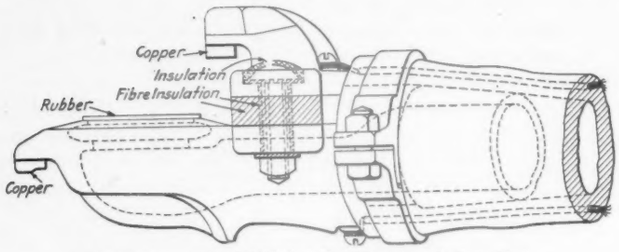
Train Signal Operated by Electricity

THE Delaware & Hudson has in use on a local passenger train an electric signal, taking the place of the usual air signal, and this device has been tested for over a year, giving satisfactory service. The train circuit is normally closed, so that any failure of the battery or wires would be at once revealed. The electric apparatus, an electro-magnet valve, sounds a whistle. There is a whistle, with a miniature semaphore, not only on the engine but in each car of the train, and all signals are audible and visible throughout the train. The whistle on the locomotive is loud enough to be heard readily above any conflicting noise. With this arrangement each signal given to the engine is repeated in each car, and it is possible with a suitable code for the engineman to signal to the conductor at any time. Signals are communicated instantaneously. The train circuit is energized by four-volt gravity batteries—one in each car. The circuit controller in each car is actuated by the usual cord extending through the car, air being taken from the train line.

The train is made up of a locomotive and four cars and runs between Troy, N. Y., and Rutland, Vt., 86 miles, six round trips a week.

The connection between the cars is by means of insulated

wire in the brake hose coupling, and the man who couples the air hose by the same operation completes the electrical connection. The couplings are insulated.



Arrangement of Wiring in Hose and Coupling

The electrical connection through the hose is said to be as effective as a separate connection could be, and its cost is less. This installation was in use throughout last winter and there was no trouble experienced from ice or snow.

The experiment on this short train has illustrated the advantage and practicability of such a signal on freight trains, and except for the difficulty incident to using foreign cars, the system could be adapted to the longest train. It would be available also for telephone communication between the locomotive and the caboose. Extensive experiments, continuing through the winter, were made also, two or three years ago, on the Canadian Pacific and the Canadian National.

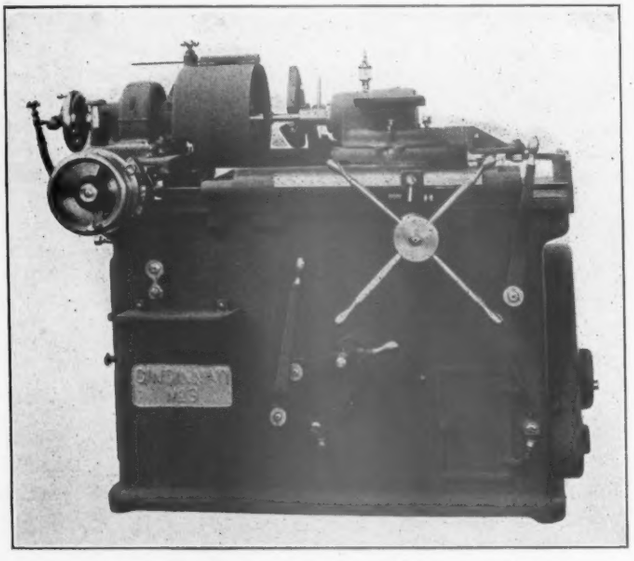
The proprietor of this system is the United States Train Signal Company, Portland, Me., and it is patented by William E. Benn and George E. Davies.

The apparatus on the Delaware & Hudson train was inspected and tested last June by the Bureau of Safety of the Interstate Commerce Commission. W. P. Borland, chief of the bureau, reporting on this test, says that "the device is designed upon sound principles, and if properly installed and maintained is capable of giving reliable train signals."

Self-Contained Internal Grinding Machine

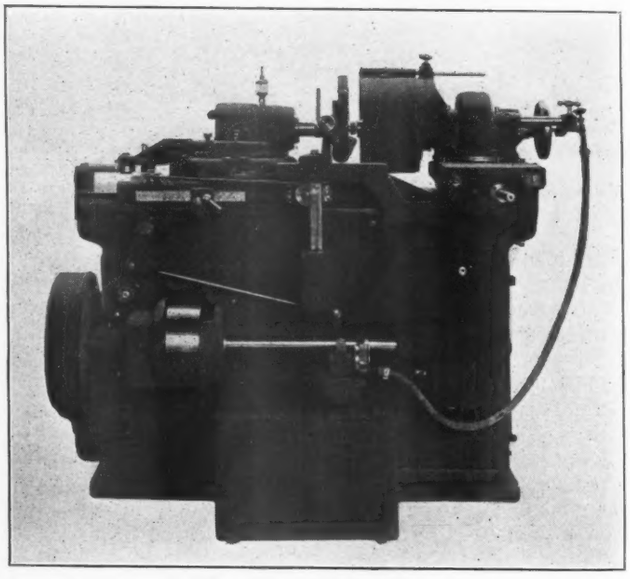
A MACHINE particularly adapted to the internal grinding of straight or tapered holes in parts which can be revolved when held in a chuck or on a face plate, has been developed by the Cincinnati Grinder Company, Cincinnati, Ohio. It can be used for grinding the holes in gears, cones, collars, cylinders, connecting rods, bushings and all work of like character which comes within its range. Face grinding can be conveniently done in correct relation to and in connection with the grinding of the holes on the external faces. This is accomplished by substituting a cup wheel for the usual straight side wheel, using the face of the former for grinding the shoulder and the periphery for grinding the hole.

Whenever it is imperative that the hole and the face of a part be finished accurately square with each other, both surfaces must be ground at the same setting. Should separate settings be made the resultant accuracy would be wholly dependent upon the closeness of the chucking which might not be within the tolerance fixed. In face grinding the position of the wheel remains unchanged, but the work-head is traversed.



No. 9 Cincinnati Internal Grinding Machine

The design of the machine consists mainly of a swiveling wheel-head carried upon a sliding table having provision for longitudinal motion, but not being movable crosswise; a work-head mounted on a cross-slide in such a manner so as to provide a sidewise movement for adjusting and feeding the work to the diameter of the wheel; an automatic reverse plate mounted on the front of the base for controlling the reversal of the table; a gear box, contained in the automatic reverse plate, for varying the speed of the table; an automatic feeding device connecting the automatic reverse plate with the cross slide feed; a gear box on the rear of the machine for controlling the rotative speed of the work; a truing diamond carrier always in position on the machine; a separate coolant tank with accompanying piping; and a complete set of water guards.



Rear View of Internal Grinder

Entirely self-contained, the machine may be driven by a single pulley from the lineshaft; by a pulley from an intermediate or jack-shaft; or, by a motor through a silent chain and sprocket. The grinding wheel is held on a spindle carried in a cylinder, tapered on the outside and mounted in a hole of corresponding taper in the wheelhead housing in which it is secured by a lock-nut. A range of wheel-heads

from maximum to minimum machine capacity is available.

Each head is a complete unit in itself, made interchangeable with all other heads. This arrangement permits of quickly substituting a head of different size when changing from the grinding of large holes to small holes or the reverse, with the additional advantage that there is no adjustment of the wheel-head required when making the change.

The forward and reverse movements of the wheel-head are obtained through the reciprocating motion of the sliding table. The direction and speed of the movement are controlled by the automatic reverse plate mounted on the front of the machine which contains a clutch of the load and fire type and a gear box supplying three changes of speed.

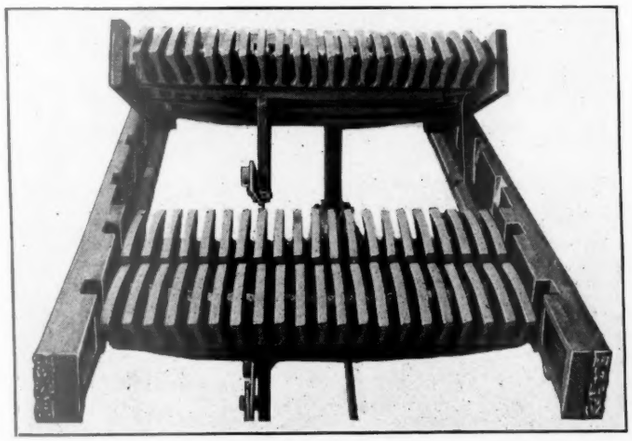
The work-head is capable of being swiveled for taper grinding to an angle of 45 deg. or less, the swiveling being accomplished by means of a hand wheel at its top, through a shaft and pinion, the latter meshing with a gear segment on the circular base of the work-head itself.

Power feed to the cross-slide, which carries the work-head, is received from the automatic reverse plate through a pawl and ratchet, the former being operated from a link set in motion by the table reverse lever. The cross-slide screw is fitted with a direct reading circular scale, for indicating the amount of stock removed, and with positive stops for use in the production of duplicate diameters.

The tank, which is proportioned to hold an adequate supply of water, carries the pump. It is separate from the machine and is set on the floor immediately next to it under the main drive shaft from which a belt runs to the driving pulley of the pump. Detachable water guards are provided.

The Hulson Shaking Dump Grate

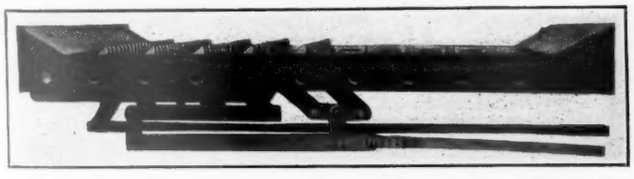
THE dump grate has always been a necessary evil in the locomotive firebox, necessary for the removal of clinkers when cleaning fires at terminals, and an evil because of the "dead" surface of the dump or drop grate, from which it is impossible to remove the accumulation of ash while the locomotive is in operation between terminals.



Hulson Locomotive Grate With the Lifting Grate Open

The effective grate area is, therefore, practically reduced by the area of the dump grate.

In order that the entire area of the grate may be uniformly effective, the Hulson Grate Company, Keokuk, Iowa, has designed a locomotive grate in which the drop grate is replaced by three finger bars in a frame which may be swung upward about a shaft journaled at the front end of the grate

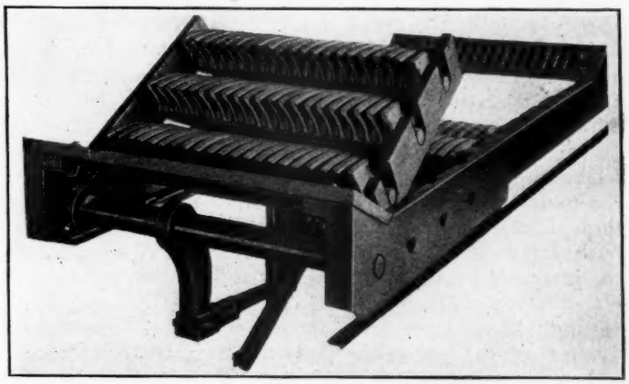


Side View of the Grate Showing the Operating Connections

frames. Standard Hulson finger bars are used in the lifting frame and they are shaken as a part of the front section of the grate.

The construction of the device is simple and will readily be understood by reference to the illustrations. It will be seen that the side and center frames are recessed at the front ends, the length of the recess being sufficient to take in the cast steel lifting frames of rectangular cross-section with trunnion bearings for the three standard finger bars. Square holes are cored through the ends of the lifting frames, which are reinforced with hubs to provide ample strength, and the frames are mounted on a 2-in. square wrought iron staff. This staff, with the lifting frames and a cast steel lifting arm mounted on it, is placed in the stationary grate frames, one end being slipped into a circular hole cored in the side frame and the other dropped into a slot in the center frame. When assembled the slot in the center frame is closed by the front tie bar.

To permit the three finger bars in the lifting frame to be shaken with the remainder of the bars in the front section of the grate, the shaker arms of the bars in the lifting



Front End of the Grate Showing the Operating Shaft and Lifting Frames

frame and those in the remainder of the section are connected independently, the two systems being united through a second connecting rod with one connection to each system. In order that the movement of the lifting frame may not interfere with the operation of the shaker rigging, the rod connecting the three finger bars in the lifting frame is extended forward so that when the finger bars are in their normal position its end is directly under the lifting shaft. The operating connection is made at this point so that when the lifting grate is open, the finger bars retain positions parallel to each other and to the grates in the remainder of the section but change their angular position relative to the lifting frame itself. Either with the lifting frame open or closed, there is no interference with the shaking of the grates in the entire section.

The lifting grate is designed to swing through an angle of over 30 deg. and provides a vertical opening between the grate and the raised fingers of about 18 in. with a considerably larger horizontal opening under the lifting frame.

The operation of the Hulson finger grates, with their freedom from slicing action on the fire, tends to reduce the amount of clinkers to be removed at terminals and the design of the fingers is such that the grates dump much more freely when the bars are moved to the full extent of the shaking movement than is possible with the usual type of finger grates. Should heavy clinkers accumulate, however, the lifting section provides a means of clearing the grate with the least possible amount of effort. After all ash and clinker which will pass through the grates has been removed by shaking, the surface of the lifting section is cleared with a hoe, the material being drawn back towards the center of the firebox. The lifting section raised and all material still on the grates is pushed forward and dropped into the ash pan. The ledges at the bottom of the recesses in the grate frames are chamfered for practically their entire length, three short lugs being left to support the lifting frames when in the closed position. Any accumulation of clinker or ash on the ledges is thus prevented and the lifting grate will always freely drop back into place.

The lifting grate is operated from the cab, its normal position being closed, and a lock is provided to hold the operating lever in the open position when the lifting grates are raised. The possibility of the dump grate opening while the locomotive is in operation is thus entirely eliminated.

The usual location of the dump grate is at the front end of the firebox and the Hulson lifting section is designed for location at that point. Should lack of clearance under the arch in locomotives with shallow fireboxes interfere with this location, it may be placed at the rear of the firebox, in which case it swings up from the rear end, under the door.

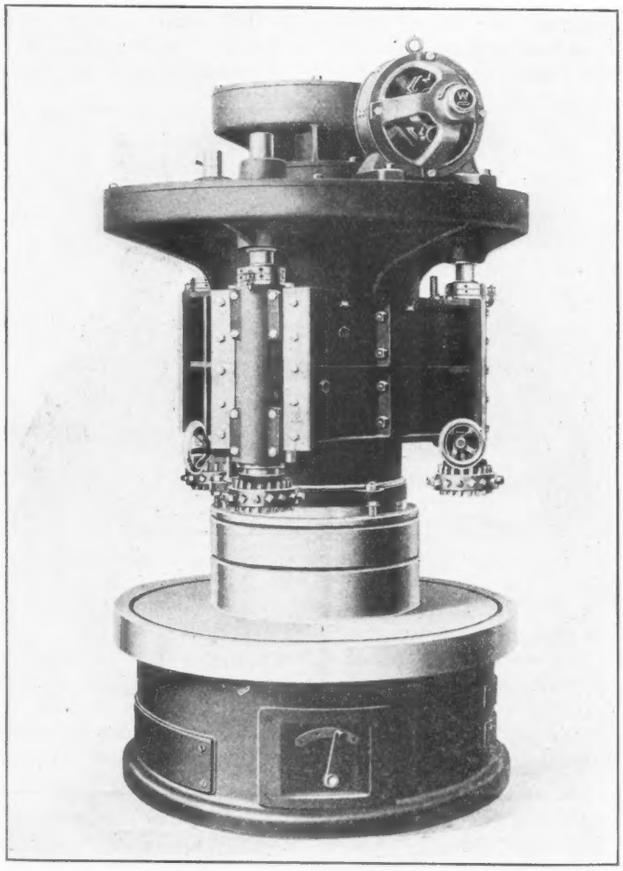
The device is simple and requires no expensive parts. The only special parts are the two cast steel lifting side frames, the square wrought iron shaft and the cast steel lifting arm. The only machine work required is the turning of the short journals. A patent has been applied for.

Continuous Vertical Type Milling Machine

THE multiple spindle continuous vertical milling machine, illustrated, is now being built by the Betts Machine Company, Rochester, New York. The machine is provided with three spindles, but it can be furnished with additional spindles to meet any requirements of work where such a design is considered desirable. The machine is intended for heavy production milling on duplicate parts and in railway shops can be used to machine journal boxes, for example. The construction is simple and rigid throughout. The spindles are machined from steel forgings and are driven through long splines and spur gears. Each of the spindles carries a milling cutter and may be adjusted vertically by hand. A four spindle machine may be fitted with two roughing cutters and two finishing cutters, thereby completing the operation in one cycle. The power for driving is furnished by either a pulley or an individual electric motor.

The table has a flat bearing on the bed, and a split tapered bushing provides for taking up wear in the bearing on which the table revolves about the column. The table is driven through a large internal gear, all bearings being bronze bushed and all gears running in a bath of oil. Four rates of continuous feed are obtained through sliding steel gears. None of the gears is in mesh except those actually transmitting power, so there is no unnecessary wear. The holding fixtures are carried on the table that revolves continuously, and no time is lost in chucking the work as the pieces are changed while the fixture is passing from one cutter to the next. Depending on the nature of the work the machine has a production capacity up to three times as great as a single spindle machine.

The maximum distance from the table to the cutter is 21 in., the table diameter being 60 in. and the maximum diameter of the cutter 16 in. The table top is 25 in. above the floor, the total height and weight of the machine being 9 ft.-6 in. and 21,000 lb. respectively.



Betts Vertical Miller With Three Spindles

Chucking Job on New Automatic Lathe

THE No. 5 automatic chucking lathe, illustrated, has been introduced recently to the American market by Alfred Herbert, Ltd., New York. Among its advantages may be mentioned the single pulley drive making a countershaft unnecessary. All operations are automatic, except chucking. The machine stops automatically at the conclusion of the work. Being low, the machine can be set up easily and controlled from the floor without a platform. No changing of cams is necessary for any work that can be done. Automatic speed and feed changes can be made while the tools are cutting. The head is adjustable longitudinally to allow for variations in the thickness of the work. The turret rotates at the extreme back end of the stroke. The turret is clamped automatically. The turret operating drum makes three revolutions for each forward and backward motion and is driven direct by a worm wheel without torsion. The front

and back cross slides operate independently of each other. These slides can work separately or simultaneously as required.

The headstock gear, cam drum and feed gears run in oil. All bearings are continuously lubricated, requiring little attention and assuring long life to the machine. It is possible to stop the spindle automatically at any instant, as at the end of a cut, enabling the tools to be withdrawn without

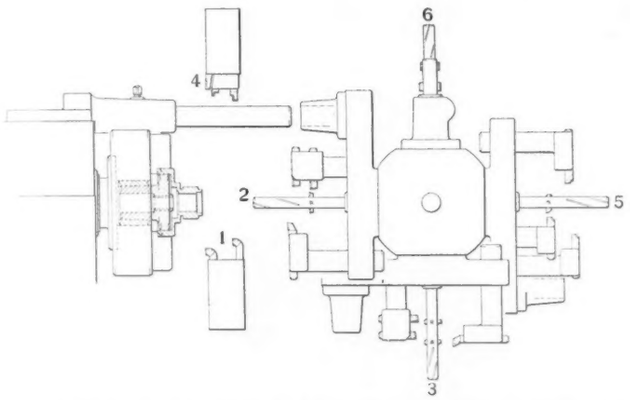


Fig. 2—Method of Tooling Automatic for Machining Clutch Gear

leaving a spiral mark on the work. The spindle restarts automatically in time for the next tool.

The more important dimensions of the machine are as follows: maximum swing over bed, 18½ in.; working stroke of turret, 13 in.; number of tool holes, 4; diameter, 2⅛ in.; maximum distance from flange of spindle to face of turret, 34 in.; minimum distance, 15 in.; diameter of turret, 11¼ in.; turret faces, 7⅞ in. by 5 in. There are seven automatic turret feeds from 16 to 144 revolutions per inch of feed. Automatic cross slide feeds are provided from 40 to 366 revolutions per inch of feed. The total speed range is from 14 to 411 r. p. m. The time for one cycle of the machine at high speed is 48 sec. The time required to rotate the turret one station is 1.1 sec. The machine consumes about seven horsepower under full load. Reference to Fig. 2 shows the method of tooling this machine for the succeeding operations on the clutch gear shown in Fig. 3.*

The gear is held on its 7¼ in. diameter in a 15 in. Coventry chuck and is located dead true by a hardened steel steady bush, which fits in the large bore. The steady bush

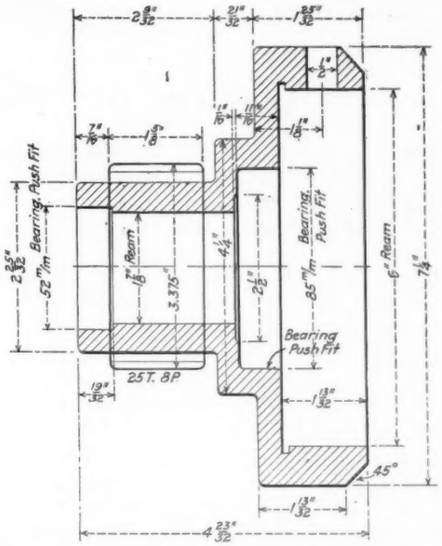


Fig. 3—Details of Clutch Gear

is lined with phosphor bronze and serves to pilot the boring bars used in the various operations.

The large shoulder and end are first faced with tools,

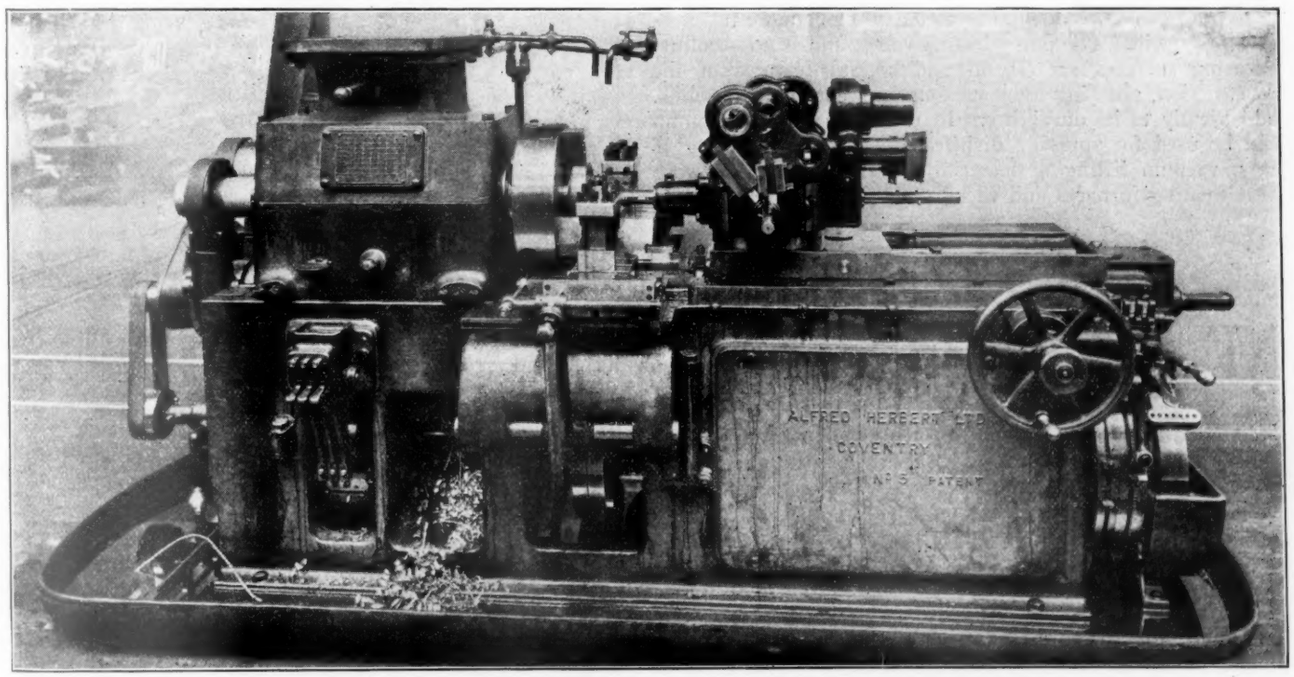


Fig. 1—Alfred Herbert No. 5 Automatic Chucking Lathe

reference 1, Fig. 2 in the tool box on the independent cross slide. At the same time, the turret is moving forward and rough turning the 4¼ in., 3⅜ in. and 2 25/32 in. diameters and opening up the 52 millimeter ball race diameter. These operations are performed by tools, reference 2, held in a combination tool holder bolted to the turret.

The second turret face carries tools, reference 3, which take

*The first machine operations on the clutch gear, illustrated, were performed on a turret lathe as described on page 669 of the October *Railway Mechanical Engineer*.

a second cut in the bore and finish cuts on the outside diameters machined by the first set of tools. At the same time the back cross slide comes in carrying tools, reference 4, in the combination tool box, and forms the small groove, finish faces the flange and forms the radius on the end. Tool, reference 5, then comes into action and forms the radii on external diameters and chamfers the bore. The final machining operation consists of sizing the 1⅞ in. and 52 millimeter bores with the floating cutters, reference 5. The limits in the bore are to .0005 in. and on the external diameters to .001 in.

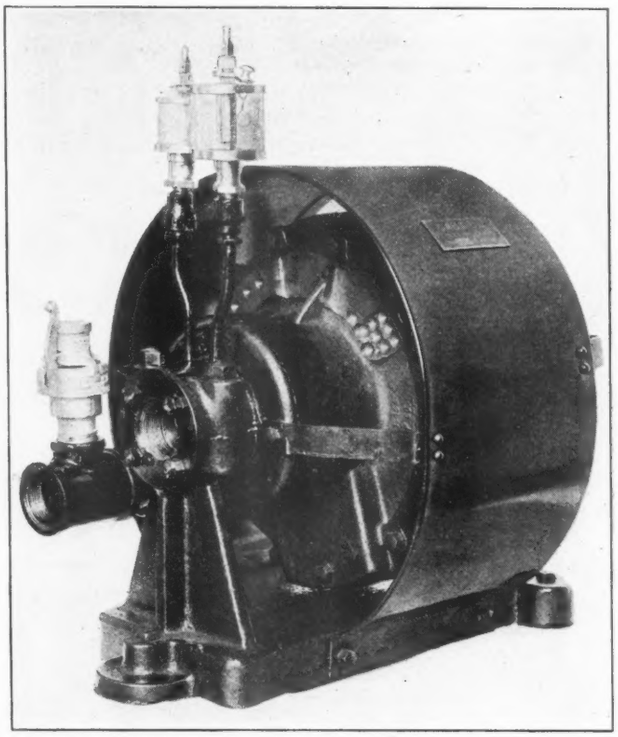
The total machining time for this operation is fifteen minutes, giving a total time of forty minutes for the complete gear.

Vacuum or Pressure Pump of New Design

AN interesting and ingenious application of motions has been introduced in the vacuum or pressure pump, illustrated, which has been placed on the market by the Crescent Sales and Engineering Company, Detroit, Mich. The motions are produced by two cylinders, one the Roto-piston, being enclosed in the other and touching it at only one point as they are mounted on different axes. The inner cylinder is revolved at the same angular speed as the outer by cranks connecting the two cylinder heads. The throw of the cranks allows the Roto-piston to maintain contact with the outer case in an apparently eccentric motion which is, nevertheless, completely balanced.

The crescent-shaped space between the cylinders is sealed at its ends by the contact of the cylinders and at another point by a vane which slides in the Roto-piston and maintains contact with the outer cylinder. The crescent-shaped working chamber remains fixed in revolution; the cylinders roll past it and the vane moves through them, displacing the space as positively as in a reciprocating pump although the motion is rotary and continuous.

Friction is small because of the few sliding contacts and the pump weighs only 150 lb. although guaranteed to create a vacuum of ½ in. of the barometer or 15 or more lb. pressure per sq. in. The pump has no valves and is self-cooling. Wearing surfaces are liberal and special features of the construction, allowing compensation for wear at these points, add greatly to its durability. In railway service, the pump can be used for spraying disinfectants, vacuum cleaning of cars, vacuum lifting of material, blowing torches, blowing heat treating furnaces and vacuum chucking.



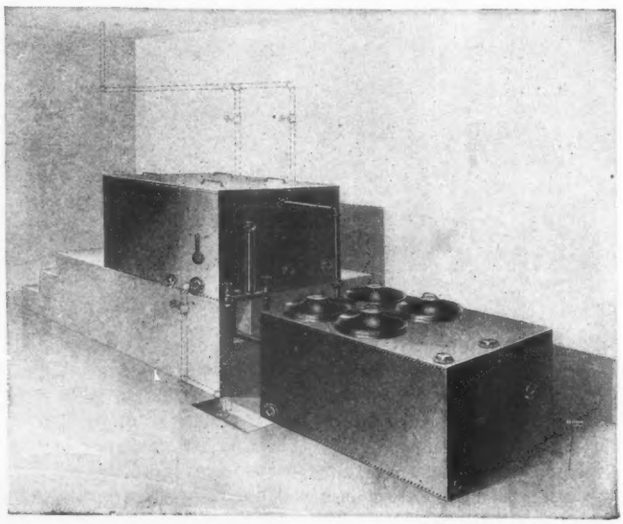
General Utility Roto-Piston Pump

Cutting Oil Filtration and Sterilization

MACHINE tool lubrication is of proven mportance, otherwise there would not be a demand for such a large number of different cutting oil liquids and compounds. It was not so long ago that the ability to increase production by liquids applied to cutting tools was recognized and water was the first liquid tried. A little experience, however, proved that a mixture of soda and water was more satisfactory all around, as the tendency to rust and corrode was largely overcome. A still further advance was the use of a cutting fluid which had not only the cooling properties necessary to absorb excess heat, but lubricating qualities as well, to decrease the power consumed and speed up production.

With the production of a cutting oil which would serve the double purpose, there came the increased cost of this item and necessity of conserving it; also, the need of an equipment to filter and sterilize the liquid, thus reducing oil expense and promoting high speed operation. A good idea of the appearance and construction of a filtering and sterilizing system designed to meet this need by S. F. Bowser & Company, Inc., Filtration Engineers, Fort Wayne, Indiana, can be gained from the illustration. Tested principles of screening, precipitation, filtration and sterilization are said to be combined in a commercial and practical manner and systems essentially like the one shown have been in service for several years, giving good results.

In operation, the system can be adapted to prevailing conditions and arranged to accomplish the work required. From



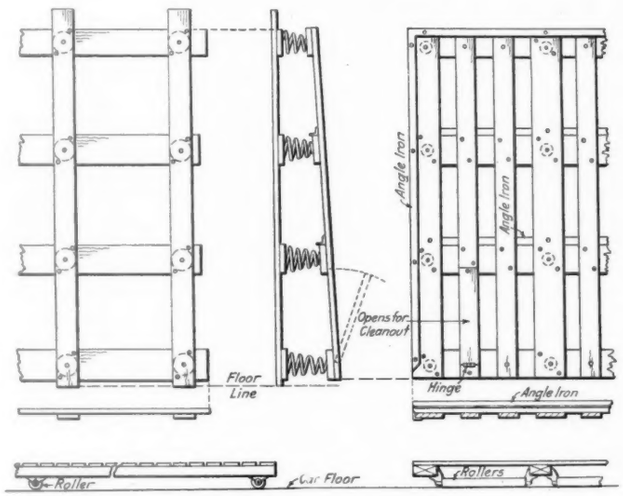
S. F. Bowser Filtering and Sterilizing System

the machines and clip separators, the oil, either by gravity or special provision, is delivered to the filter and sterilizer which automatically removes foreign matter. After going through a series of compartments, screens, filtering devices, etc., the liquid is delivered to the filter tank, which acts as a temporary storage. From this tank, the oil is returned to the machines practically the same as new oil and used again.

While the filtering process, which is automatic, is under way, the oil is also sterilized, which tends to eliminate obnoxious odors and prevent infection, thereby preserving the health of the employees. By this conservation, a better grade of oil can be used which will not rust the work or tools.

Shock Absorber for Refrigerator Cars

IN 1914, a device known as the Cutler-Monesmith shock absorber was developed by George E. Cutler, New York, and B. L. Monesmith, Cresco, Iowa, for the purpose of reducing egg breakage in shipment. The device was adapted for refrigerator cars or sheathed freight cars and could be used for shipping other products than eggs. The original arrangement consisted of a loose floor racking supported on pieces of 2-in. pipe with spring buffers at either end of the car to absorb the shock. This arrangement was somewhat crude and recent developments are shown in the illustrations.

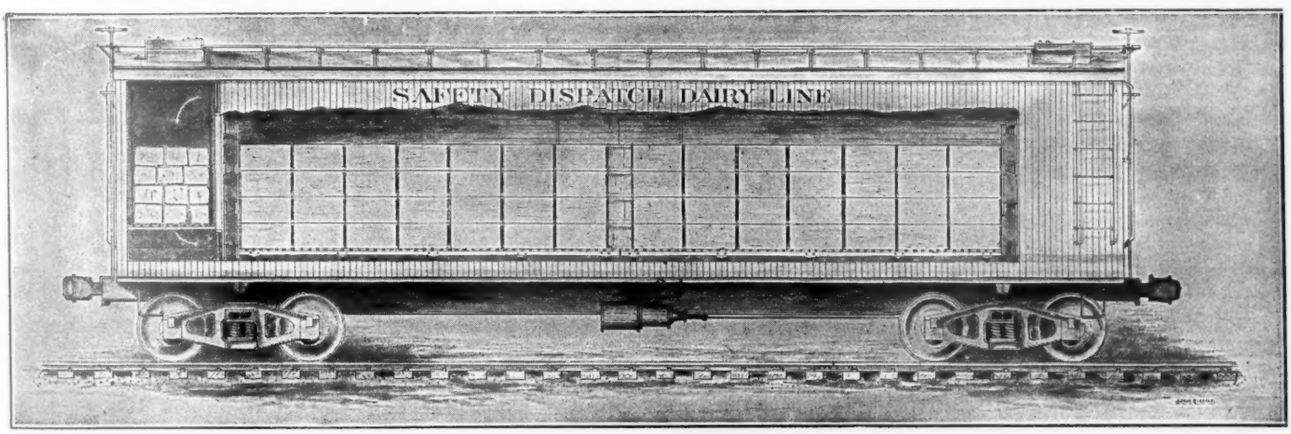


Details of Buffer Construction

The principle of the improved shock absorber is the same as that of the first device, namely, the load is held as a unit within the car on a movable floor, the shock being absorbed by spring buffers at either end. There must be no projections on the interior of the car sides to interfere with lateral movement of the load. The correctness of the principle involved was amply demonstrated by the condition of the Santa Fe refrigerator despatch car No. 8650, which arrived in New York recently loaded with eggs from central California and equipped with the Cutler-Monesmith shock absorbing device. This car was one of five test cars. As shown in the illustration, there is a space in the center of the car which was occupied by 2-in. by 4-in. bracing. As soon as the car door was opened, it was evident that the bracing had collapsed due to a severe shock, and caused some damage.

Twenty-three cases of eggs were broken, due to the collapse of this bracing, and not caused by any defect in the shock absorber. The demonstration of the efficiency of the shock absorbing device was more convincing because of the evidence of exceptionally severe and violent usage of the car. It was felt that with a proper center bracing or filler in car No. 8650, practically no breakage of eggs would have occurred in spite of the heavy shocks. Results of the test vindicated the contention of Messrs. Cutler and Monesmith that the load must be made rigid within the confines of the movable carriage and be sufficiently separated from the car sides to permit forward and backward oscillation without contact.

The floor racks are made of 1-in. by 4-in. slats and 2-in. by 4-in. stringers. It will be noticed in the line drawing that the lowest spring is greater in free length than the highest one. This gives a greater spring compression at the bottom of the buffer, where it is most needed. The length of the floor section is made such as to cause the front racks or buffers to stand in a vertical position. The width of the buffer is ¾ in. less than the interior width of the car. The buffers are ordinarily 5 ft. 8 in. above the floor of the car and 1½ in. less than the width of the car. All buffers and floor racks receive one coat of linseed oil, well rubbed in. The metal work in the device is treated with an anti-rust process.



Phantom View of Cutler-Monesmith Device Applied to Refrigerator Car

The rollers shown are made of extra heavy 1⅞ in. pipe, the journals being welded into each end of a steel plug 1¼ in. long. The journals are ¾ in. in diameter. The bearings are ordinarily made of malleable steel castings designed to support the load with a generous factor of safety. The

springs are made of spring steel wire, oil tempered and carefully coiled to correct form and dimensions. Each end of the buffer is provided with two clean-cut openings, or hand-holes, of sufficient size so that the ice bunkers may be readily cleaned. The hand-holes have a hinge at the bottom and lag screws at the top as illustrated.

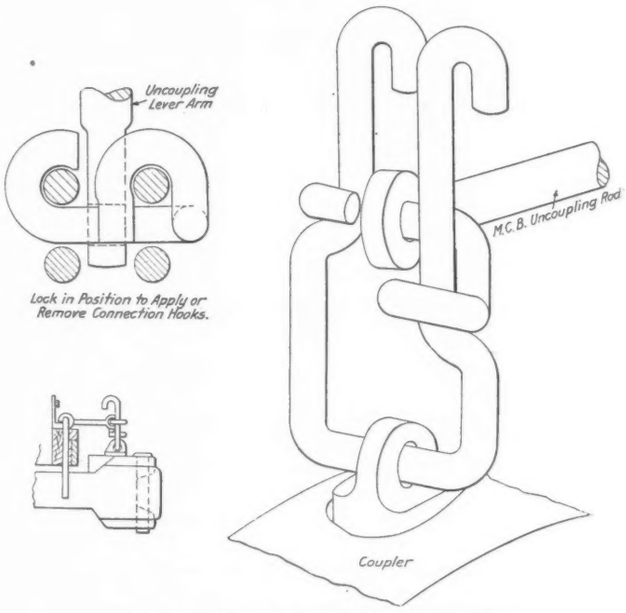
Another important advantage of this device is the fact that the load rests a few inches above the floor of the car and there can be no damage due to water. The device is adaptable to use for other merchandise and food products, being by no means limited to the transportation of eggs. In case heavier material is to be shipped, it would only be necessary to furnish springs of greater tension and possibly insert two extra springs in the bottom row. The ideal spring tension would be one sufficient to gradually return the load to its central position after a shock, and thus have it ready for the next shock.

Greater production of all kinds of material, including food products, is the compelling cry of the times, but "a penny saved is a penny earned" and the conservation of food supplies is just as important as their production. An idea of the magnitude of egg breakage and resultant loss may be obtained from a statement given out by competent authorities. During the months of May, June, July and August last, American railroads were obliged to pay one shipper alone $40,000 in damages to eggs shipped across the continent. The importance of any device tending to eliminate or reduce this breakage is therefore apparent.

Release Connection for Car Couplers

THE chain and clevis connection between the uncoupling rod and the coupler lock is troublesome to maintain in proper condition and has been responsible for a large proportion of the violations of the Safety Appliance Act falling under the classification of inoperative couplers. As a great many cars now in service are equipped with uncoupling rods to fit clevis connections, there is a large field for devices that will avoid the defects of the former standard M. C. B. design and can be applied without changing the rod.

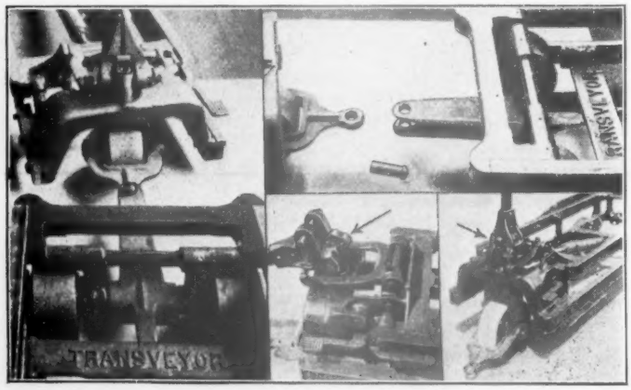
A car coupler release connection that can be applied quickly to any M. C. B. coupling lever has been invented recently and a patent on the device has been issued to Edwin Jones, passenger car foreman, Baltimore & Ohio passenger station, Cleveland, Ohio. As shown in the illustration, the connection is applied or removed simply by turning the lock fully over, when the center arm of the uncoupling lever is raised up to the connection hooks. There is no prying open or closing up of open eyes, hooks, or any other parts and the device can be applied or removed as many times as desired without weakening or destroying it. The E. D. J. O. coupler release connection, as it is called, is stated to be reliable, durable and efficient in action. Its simplicity and ease of application will be appreciated by car repairmen who have been used to the older types of connection.



Easily Applied Coupler Release Connection

Trailer Attachment Applied to Transveyor

THE attachment illustrated enables the Type G transveyor manufactured by the Cowan Truck Company, Holyoke, Mass., to be used as a trailer behind electric storage battery trucks, either singly or as a train. The attachment fits onto the front wheel and hitches to the draw bar on the rear axle of the transveyor ahead of it, or the draw bar of the electric truck. No change in the construction of the transveyor is necessary except a longer axle for the front wheel fork. The draw bar is applied to the rear axle of any transveyor without taking off the wheels, as it merely slips over the rear axle. Both the attachment and the draw bar are steel castings and will stand up under any ordinary conditions.



Cowan Transveyor Trailer Attachment and Safety Latch

In this arrangement the shortest possible connection is provided for, so that the train will be no longer than is absolutely necessary. The truck wheels follow in the same track and the turning radius is so short that a train of ten trucks has been turned in a circle on a twenty foot roadway. Plenty of up and down play is allowed so that there will be no binding as the machines go over the door sills or the top of steep inclines.

A safety handle latch has been devised for the transveyor as indicated in the illustration by arrows. This latch is made of tempered spring steel attached to the top of the king pin of the front wheel fork. It has two leaves, stiff

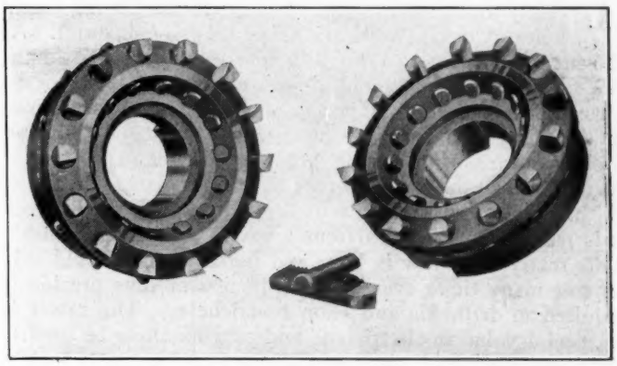
enough to prevent the handle from falling down. As the handle is thrown back into a vertical position, it slips over the spring, and no amount of jarring will cause the handle to fall forward. The latch, however, does not interfere with the free movement of the handle, when it is necessary to bring it down to manipulate the transveyor.

Inserted Tooth Face Milling Cutter

A NEW inserted tooth face milling cutter known as the type A cutter has been developed recently by the Lovejoy Tool Company, Inc., Springfield, Vt. The cutter is of the inserted tooth type, being recommended for all face milling operations where the depth of cut does not exceed 9/16 in. The cutter bodies are made of a tough hardened steel, designed to withstand the most severe usage. The teeth are positively locked by means of taper pins, as illustrated. This arrangement is stated to prevent any possibility of slipping or loosening under heavy or intermittent cuts. The teeth are made to gage and are interchangeable with a liberal amount of stock provided for wear.

The ease with which the teeth are adjusted forward to compensate for wear, or replaced with new ones when necessary, is an obvious advantage. It is stated that this type of body is well adapted for holding stellite and can be furnished with stellite teeth when desired. The time consumed in grinding a cutter of this type is reduced to a minimum.

The new type A cutters are made in five sizes from 6½ in. diameter to 10 in.



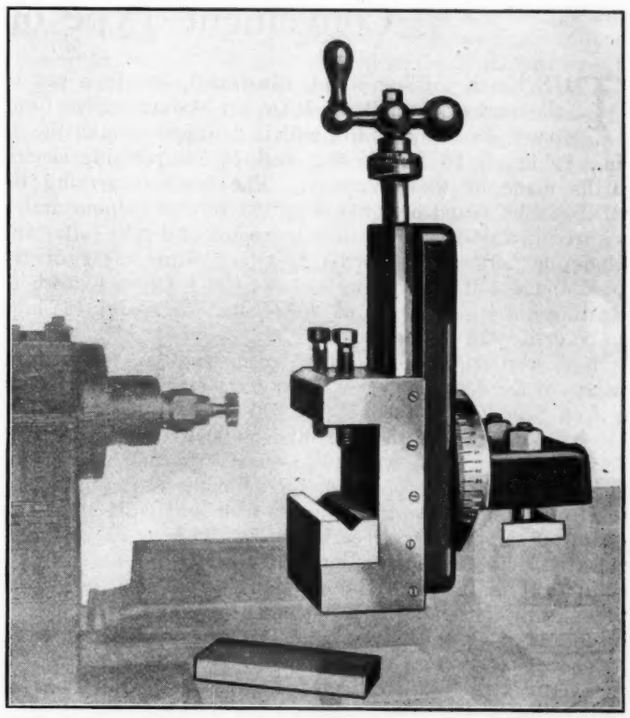
Lovejoy Inserted Tooth Face Milling Cutter

Milling Attachment for Use on Lathes

A COMPARATIVELY simple milling attachment which can be applied to engine lathes has been placed on the market by the Hinckley Machine Works, Hinckley, Ill. This attachment is adaptable to a great variety of light milling work, such as milling keyseats for both plain and Woodruff keys, squaring the ends of shafts, sawing, splining shafts, splitting bushings, drilling, boring, and numerous other jobs.

The attachment is shown in the illustration and may be applied to lathes of any make and size from 12-in. to 24-in. swing. The device swings with the compound rest to bring shafts in the right position to cut keyseats. The steel V-block lines up the shaft, which is held firmly in place by two set screws. In order to prevent marking the shaft, the block shown in the lower part of the illustration is usually placed between the shaft and the screws. A Woodruff keyseater cutter is held in the lathe spindle as shown and mills the key way.

The low center of oscillation makes the device rigid, a feature which is also secured by the use of two substantial bolts holding the attachment firmly to the cross-slide saddle. The vertical hand feed of the attachment is seven inches up and down, the cross and length feeds being the feeds of the lathe. Vertical feed is provided by means of a hand-operated ball crank and is graduated to thousandths of an inch. It is graduated to swivel in a vertical plane to 180 deg. This device can be provided ready for application to any engine lathe by submitting the dimensions of the toolpost saddle with the order.



Attachment Set Up Ready to Cut Keyseats

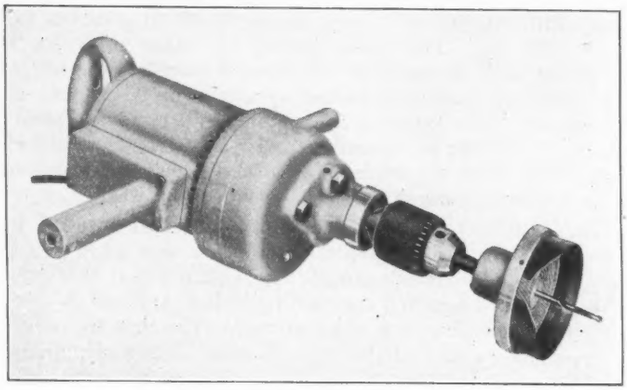
A New Duff Automatic Lowering Jack

THE Duff Manufacturing Company, Pittsburgh, Pa., has recently added to its line of automatic lowering jacks a new jack (No. 339) designed especially for removing and replacing couplers and for bridge work. A capacity of 15 tons and a lift of 11½ in. are provided. The jack has the simplified reversing mechanism of the Duff jack (No. 229) previously described in detail on page 531 of the September, 1918, *Railway Mechanical Engineer*. A fine-tooth rack and the reduction of friction makes the jack operation easy, and long life is ensured by strengthening

the jack at all points where experience has shown it to be desirable. The jack is single acting, raising only on the down stroke of the operating handle. Another advantage from the storekeepers' point of view is the fact that all parts of the new jack except the rack and base are interchangeable with the corresponding parts of previous car and journal jacks, Nos. 219, 249 and 248. This will eliminate the necessity of carrying so many different parts in stock.

Rotary Hack Saw Cuts Round Holes

THE Misener rotary hack saw has been developed recently and proved a satisfactory tool for cutting round holes in metal, wood and other kinds of material. As shown in the illustration, the principle of the device is simple, since it consists of a holder, driven either by a motor or by a common bit brace, arranged to hold a hack saw blade bent in the form of a circle. Concentric grooves in the holder provide means of obtaining holes of different sizes and a small drill at the center serves to hold the tool on center. With a set of the hack saw blades furnished with this tool, it is possible to cut holes from 1 in. to 3½ in. in diameter. This rotary hack saw is light and portable and should save its cost many times over in the reduction of time previously required to drill, file and ream round holes. The device is of special value to electricians and can doubtless be used to very good effect by tinsmiths in locomotive shops who have to cut many holes through jacket iron for pipes, etc. Carpenters in the cab shop will also find many excellent opportunities to use this ingenious device. John Conolly, Rochester, N. Y., is exclusive sales agent for the Misener rotary hack saw and is prepared to make deliveries at an early date.



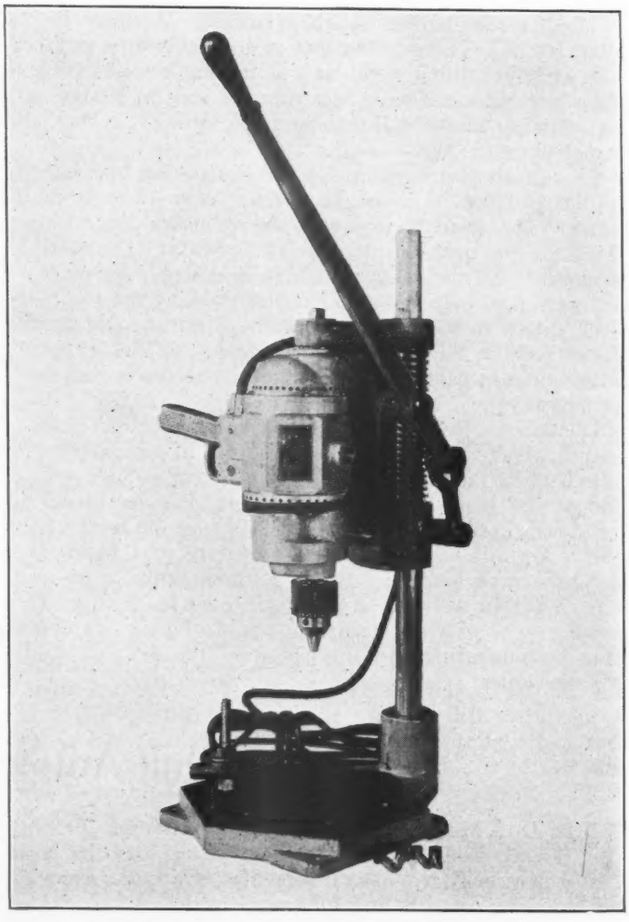
Misner Rotary Hack Saw

Convenient Type of Bench Drilling Stand

THE bench drilling stand, illustrated, has been put on the market by the Black & Decker Manufacturing Company, Baltimore, Md., and is designed to take the ⅜ in., ½ in., 9/16 in., ⅝ in., and ⅞ in. portable electric drills made by that company. The bracket carrying the drill can be raised or lowered on the vertical column and is secured in any desired position by means of a split collar and clamping screw. The drill may be swung clear of the base, making it possible to use this stand for such work as drilling holes in the ends of shafts, and other work too high to be drilled on the bench.

Both vertical and horizontal adjustment are secured by means of the clamping screw. An extra long feed lever gives a feed ratio of six to one and 100 lb. pressure applied to the handle will feed the drill under 600 lb. pressure. This facilitates fast work with little effort. In the base of the stand, there are six tapped holes to accommodate ½-in. studs, used to clamp the work in place. One stud with a nut and clamp is supplied with each stand. The stand is exceptionally rigid in construction, the vertical column being a solid steel shaft 1-7/16 in. in diameter. The base is provided with four holes for fastening the stand to the bench by means of ⅜-in lag screws.

The distance from the bottom of the base to the top of the vertical column is 30 in., the vertical adjustment of drill being 12 in. The distance from the center of the drill bit to the circumference of the vertical column is 7 in. The vertical travel of drill when operated by the feed lever is 4 in. The net weight is 70 lb. The stand is shipped complete with an adapter block. The sizes and types for which adapter blocks are suitable are stamped on the blocks and only Black & Decker portable electric drills of corresponding sizes and types can be used. Perhaps the main advantage of the drilling stand, not previously mentioned, is due to the fact that radial drills and large drill presses are usually overcrowded with work and by doing many small drilling jobs at the bench, large drills are relieved of that much work.

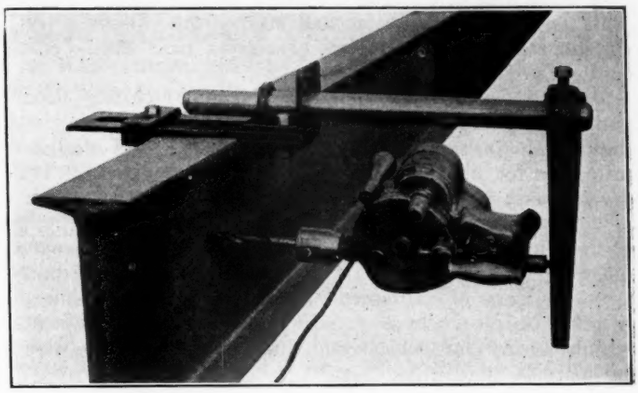


Black & Decker Bench Drilling Stand

Adaptable Drill Clamp and Support

AN efficient device known as the Canton drill clamp and support has been placed on the market recently by the Poyser-Bucher Company, Canton, Ohio. This tool is intended for use on bridge and construction work where many holes have to be drilled in I-beams. Formerly such work was done with the drill held by a goose-neck, or old man, which is a more or less inefficient and expensive method because the length of time required to adjust the old style goose-neck was considerable. Also a separate adjustment had to be made for each hole.

The operation of the drill clamp and support illustrated is readily understood. By loosening up the nut and casting at the left, the support can be slipped along and a hole drilled at any point in the web desired. Should it be desired to drill holes in the top of the I-beam, the long shaft is removed and put through the support in a position at right angles to its present position. The U-bolt is then tightened around the shaft and holds it at the desired height, no further adjustment being necessary for drilling as many holes as may be desired in the top of the I-beam. The total saving in time when drilling several hundred holes is surprisingly large.



Canton Drill Clamp and Support

Recent Improvements in Cincinnati Planers

SEVERAL recent improvements in the planers manufactured by the Cincinnati Planer Company, Cincinnati, Ohio, are worthy of special attention because they mark the more extended use of the box section in planer construction. The box arch, illustrated in the upper part of Fig. 1, was designed primarily to add strength and stiffness

Fig. 1—Views Showing Box Section Construction of Planer Arch and Cross Rail

to the housings and the upper part of the planer. This box arch is cast in a strictly box form, as shown. The top of the housings of the planer have been widened to accommodate the arch and ample provision is made for securely bolting the arch in place at all four corners.

The box form of construction has also been extended to the cross rail. Instead of the more familiar type of curved back, the cross rail is now constructed, as shown in Fig. 1, with a deep heavy box section which is well ribbed. It is stated that this construction adds rigidity and firmness to the machine and makes it possible to take considerably heavier cuts.

An automatic stop for the rail elevating and lowering device is clearly shown in Fig. 2, and provides a valuable safety feature which combines simplicity and convenience. In operation, the elevating device is released by the movement of a vertical stop rod, shown at the left side of the housing. This stop rod is provided with two stop collars adjusted at the limits of safe vertical travel of the cross rail. A third collar can be adjusted to stop the downward movement of the rail at any position within its range of travel. A new style saddle is shown with provision made for clamping the upper part of the swivel securely against the face

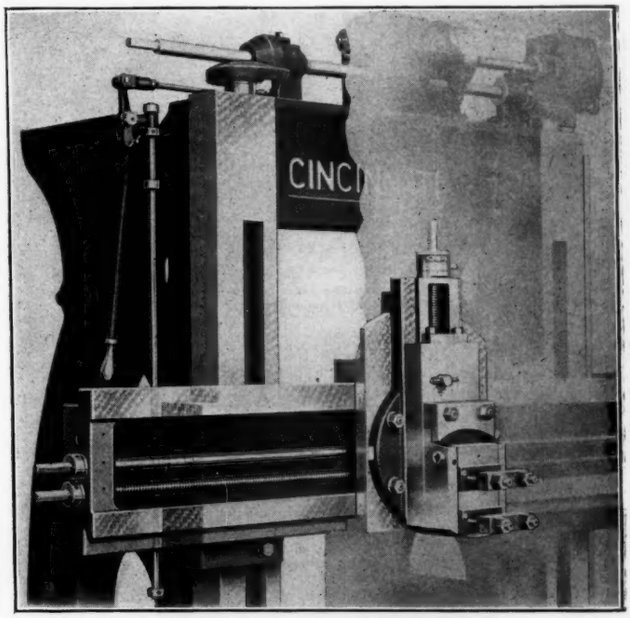


Fig. 2—Automatic Safety Stop for Elevating and Lowering Device

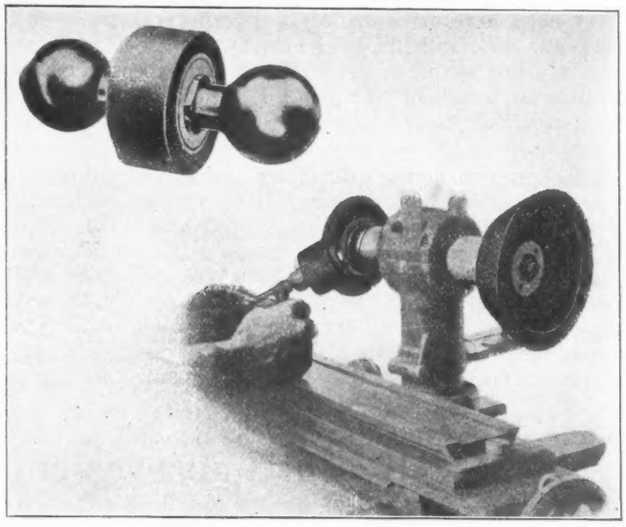
of the saddle by means of a clamp. This arrangement is designed to prevent the possibility of breakage to the clapper box. Rapid power traverse for moving the rail head into position quickly and easily is another advantage claimed for this planer.

Grinding Wheel Dresser for Fine Wheels

IT is essential that grinding wheels be kept in the best possible cutting condition because tools cannot be properly ground with wheels that are either out of round or clogged. This is especially true in tool room work where milling cutters, reamers and all sorts of cutting tools must be accurately ground.

With these facts in view the Oliver Machinery Company, Grand Rapids, Mich., has developed the Metcalf grinding wheel dresser, which is recommended and designed primarily for fine wheels 1 in. or less in thickness. This device makes it possible to turn a bevel or V-edge, or true up a square edge quickly and effectively. It prevents chipping or breaking away of the grinding wheel. On large coarse snagging wheels the Metcalf dresser is intended to supplement the work of a diamond dresser and assure a smooth grinding surface. It is equally adapted for surface and cylindrical grinding wheels and can be used in places where the space is limited.

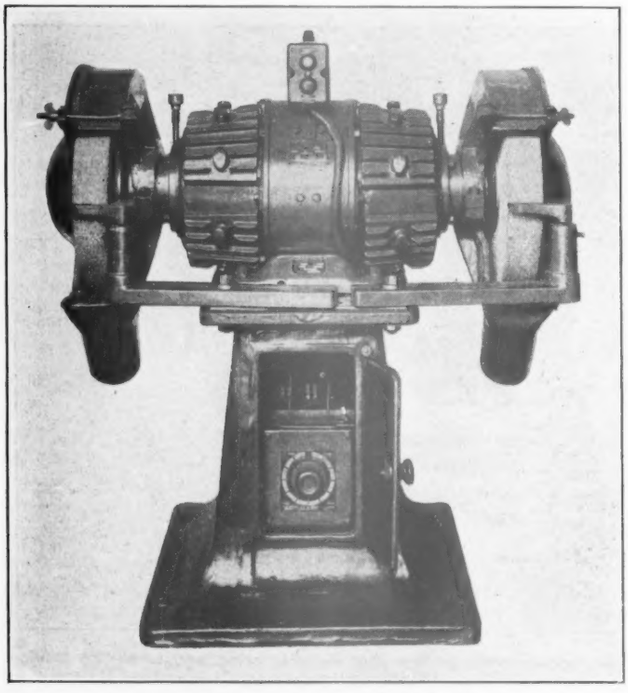
Three styles of grinding wheel dresser are provided for ordinary shop use. Type A is recommended for turning square, round, bevel or V-edges on wheels 1 in. or less in thickness. This is the most commonly used type and is very convenient for tool room use. It is shown in the illustration with the two ball handles. Type B, not illustrated, is provided with a shank which may be fastened in the tool post. Type C is designed for working in tight places, as, for example, grinding the bevel on the small wheel shown. It will dress the sides on straight or dished wheels and dresses special shapes internally.



Two Types of Oliver Grinding Wheel Dresser

Electrically Driven Tool Grinding Machine

THE self-contained electrically driven grinder illustrated is particularly rugged in construction and therefore adapted to the more or less severe usage accorded machine tools in railway shops. Vibration is reduced to a minimum by providing the large base shown, with a column of generous proportions.



United States Electrical Tool Grinder

Power to drive the grinder is furnished by a 5-hp. direct current motor enclosed within the casing. Ample provision is made for the inspection of the motor, which is protected from possible injury due to falling articles by the heavy iron casing. The motor was designed especially for grinder service, being a variable speed motor with speeds ranging from 1,100 to 1,600 r.p.m.

Arrangements for increasing the speed as the grinding wheels wear down are made by means of electrical equipment shown in the pedestal of the grinder. The machine is started and stopped by means of two push buttons and is furnished with S. K. F. ball-bearings throughout. Grinding wheels 18 in. in diameter with 3 in. faces are to be used with this machine.

Wheel guards of the hinge door type, amply strong to guard against accident, are provided for the grinder as shown; also exhaust connection for carrying away the particles of dust and metal. Adjustable rests are provided for the support of tools while being ground. The grinder is manufactured by the United States Electrical Tool Company, Cincinnati, Ohio.

Rules for Handling Die-blocks.—The following rules for the handling of die-blocks are given by the Pennsylvania Forge Company, Bridesburg, Philadelphia, Pa., in a recent publication entitled "Die-blocks":

1. Never harden a block unless the impression has been carefully polished. Rough impressions are the cause of many failures.
2. Never charge cold blocks into a hot furnace.
3. Never rush heating operations. Take plenty of time and save trouble.
4. Never quench a block that shows uneven heating. If properly "soaked," the color and temperature will be the same throughout.
5. Never allow a block to become dead cold in the bath.
6. Never postpone the drawing of a die-block. Draw it immediately after hardening.
7. Drop-forging dies should never be stored in a cold, drafty place after hardening.

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WE GUARANTEE, that of this issue 10,950 copies were printed; that of these 10,950, 9,573 were mailed to regular paid subscribers, 13 were provided for counter and news company sales, 259 were mailed to advertisers, 32 were mailed to employees and correspondents, and 1,073 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 127,050, an average of 11,550 copies a month.

The *Railway Mechanical Engineer* is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.).

The Railway Business Association will move its office on November 1 from New York to Philadelphia, Pa. The new office of the association will be in the Liberty building at Broad and Chestnut streets.

Tasmania produces most of the molybdenite which is used in the manufacture of steel to give it a hardness and toughness that fits it for use as propeller shafts, long range guns and boilers that carry unusual pressure.

Twenty per cent reduction in the forces of the shops of the Norfolk & Western is to be made at once, according to a notice posted at Roanoke, Va. The reduction, according to the notice, will begin with laborers and helpers.

New York Central engine No. 999, which established the world's record in May, 1893, when it drew the Empire State Express at the rate of 112.5 miles an hour covering a mile in 32 sec., has now been placed on a side track at Depew, N. Y., where it will be dismantled and scrapped. Charles Hogan, now manager of the department of shop labor of the New York Central, handled the throttle on the record-breaking run.

The steel industry looks to the railways to keep it in a healthy, normal condition for some time to come, in the opinion of Charles M. Schwab, as stated in a recent interview. He pointed out that normally the railways use about one-third of all the steel produced. For the past five years railway purchases have fallen far below this average, and Mr. Schwab believes that a steady production of steel for several years will be necessary to make up this deficiency, even if orders from other sources fall off.

The proceedings of the annual meeting of the Mechanical Section of the American Railroad Association held in Atlantic City, N. J., June 9-16, 1920, are now ready for distribution and may be obtained from the secretary, V. R. Hawthorne, Chicago. The Rules of Interchange and Tank Car Specifications, as revised at the annual meeting, have been approved by the Executive Committee and will be ready for distribution in a short time. The new rules and specifications will become effective November 1, 1920.

Out of an order, handled by the Dutch Colonial Office, for 82 locomotives for the Java State Railways, 58 went to German builders and 24 to Dutch builders, who will obtain much of the needed material from the Germans. The order includes 2-8-2, 4-6-2 and 2-4-2 locomotives of a fair size. An American concern tendered bids on the 2-8-2 engines, but lost the order to the Germans as the latter offered the same deliveries and agreed to build at a price which was 40 per cent lower, under the existing rate of exchange, than the price of the American bidder.

Shop Tools

The Southern Pacific, Texas & Louisiana Lines have authorized the expenditure of $700,000 for the purchase and installation of shop tools.

Russia Contracting with German Locomotive Manufacturers

LONDON.

It is stated in the Dagens Nyheter that the Russian representative, Professor Lomonosov, recently visited Berlin, where he made a contract with the Locomotive Manufacturers' Trust for the delivery of 1,500 locomotives within one year. It is stated that the Saxon Engineering Company, formerly Richard Hartmann & Co., of Chemnitz, has received an order for some of these locomotives to the value of 30,000,000 marks (approximately $500,000).

Belgian Railways Approach Normal Again

Belgian railways are steadily being restored to normal, according to a report received at Washington from Trade Commissioner Samuel H. Cross at Brussels. Several of the lines put out of commission by the war have been completely restored. The repair shops report their efficiency at 50 per cent of that of the prewar days. A premium system for enginemen to encourage economy in repairs and fuel consumption is reported to be producing favorable results.

Recent Locomotive Orders

The Western Maryland has ordered 40 Consolidation locomotives from the Baldwin Locomotive Works.

The Illinois Central has ordered 25 switching locomotives from the Baldwin Locomotive Works.

The Paris-Orleans has ordered 50, 4-6-2 type locomotives from the American Locomotive Company.

The Canadian Pacific has ordered 15 Mikado type locomotives from the American Locomotive Company. These locomotives will have 25½ in. by 32 in. cylinders and a total weight in working order of 320,000 lb.

The Market for Cars in Cuba

That Cuban sugar mills are large owners of rolling stock is pointed out by Trade Commissioner H. A. Chisholm in a recent report to the Canadian Department of Trade & Commerce from Havana. There are 193 sugar mills operating now in Cuba and it is estimated that they own 15,000 cane cars and 600 locomotives. Most of the railway lines operated by these mills are of standard gage. American cars are favored in the Cuban tariff by a re-

duction of the ad valorem duty from the 31.25 per cent, which manufacturers of other nations must pay, to 11.25 per cent. This gives American manufacturers a decided advantage over foreign competitors. Some Cuban railways are, however, under British control and there is a disposition to favor British bidders when it can be done without increased cost.

Shop Construction

Atchison, Topeka & Santa Fe.—A contract has been let by this company to J. E. Nelson & Sons, Chicago, to construct a machine shop at Albuquerque, N. Mex., to cost approximately $1,250,000. This shop will be the central structure of a group of six other buildings to be constructed later. This building will be constructed of steel and glass and will have a composition roof and a mastic floor. There will be 26 engine pits. It is to be heated by a fan system placed in the upper structure.

China Standardizing Its Railways

The Chinese Ministry of Communications is making good progress in determining standards for the government railways of that country. The Commission on Railway Technics was organized in 1918 to make observations and recommendations regarding standards for all phases of railway work. It is expected that, once uniform materials and equipment are decided upon, those manufacturers who can supply the specified materials most efficiently will secure the Chinese trade. The Ministry desires to have some of the railway supply industries locate in that country if possible.

Chilean State Railways Poorly Equipped

Reports from Valparaiso say that the Chilean State Railways have reached their maximum carrying capacity, which meets about half of the transportation needs of the country. Owing to the difficulty of negotiating a foreign loan for the purchase of equipment abroad, the government is being urged to stimulate the manufacture of railway supplies in Chile. It has been about eight years since new equipment in large quantity has been purchased. In the meantime needs for new rolling stock to provide for additional business and for deteriorated equipment have grown apace.

Freight Car Orders

The Northern Pacific has ordered 93 caboose cars from the Pacific Car & Foundry Company.

The Gulf Coast Lines have ordered 500 box cars and 50 tank cars from the American Car & Foundry Company and 400 gondola cars from the Mount Vernon Car Manufacturing Company.

The Western Pacific has ordered 700 50-ton composite general service cars from the Pressed Steel Car Company.

The Wheeling & Lake Erie has ordered from the Standard Steel Car Company 1,500 50-ton steel gondola cars; from the Pressed Steel Car Company, 500 50-ton steel gondola cars and 500 40-ton box cars; and from the American Car & Foundry Company, 500 40-ton box cars.

Air Brakes on Swedish Railways

It is now announced that the Kunze-Knorr air brake, a German invention, with which the rolling stock of the State Railways in Sweden are to be equipped, will involve an expenditure of no less than 30,000,000 crowns, which at normal rate of exchange represents $8,150,134.

The railway officers estimate the annual saving from the use of this particular air brake at 5,500,000 crowns, or $1,474,530 at normal exchange, and this because of the consequent reduction in the number of railway employees. These Kunze-Knorr air brakes are to be made in Sweden, Aktiebolaget Nordiska Armaturfabrikerna, at Lund, having made a contract with the German company to manufacture them.

The Swedish private railroads have been reluctant to adopt air brakes, but it is probable that sooner or later they will follow in the footsteps of the State Railways. It would, therefore, be well, says Consul General Dominic I. Murphy, who sends the above information to Commerce Reports, for American manufacturers of air brakes to get in touch with the private railroad companies in Sweden, as it is quite certain that the German company cannot undertake to equip them at least for a year or two.

School for Railway Employees in Berlin

Berlin, Germany.

A school for railway employees was founded in Berlin about a year ago and the first annual meeting was held on July 15, 1920. At this meeting it was stated that owing to the success of this school, 20 branch schools were opened in the Prussian-Hessian railroad district during the year and that about 18,000 pupils are registered. It is planned to open a further 36 schools in the near future. It is the aim of the school to give all progressive employees the possibility of further education. It therefore has established courses on general educative subjects given by well-known teachers of high schools and universities, and in addition special courses on railway matters. As both the workers and the employees' trade unions are in favor of and are co-operating in the scheme, the government has declared its willingness to promote and further the movement as far as possible.

Modifications in Prices in Interchange Rules

The mechanical Section of the American Railroad Association has issued circulars S III-166 and S III-168 announcing changes in the labor rates for repairing foreign cars and in the maximum amount of labor chargeable to cars under Rule 120. Circular S III-166 reads as follows:

Since Supplement No. 3 to the 1919 Rules of Interchange was prepared and approved, the labor rates paid by the railroads to employees engaged in car repairs have been increased. Therefore, effective September 1, 1920, the rates to be charged for labor repairing foreign cars shown in Supplement No. 3, 1919 Rules of Interchange, effective same date, are modified as follows:

Freight Car Code.—Rule 101, Item No. 172, labor rate for ordinary car repairs; changed from $1.00 to $1.20 per hour. Rule 107, Item No. 443, labor rate for repairing and testing steel tanks of tank cars, changed from $1.25 to $1.45 per hour.

Passenger Car Code.—Rule 21, Item No. 19, labor rate on lubrication; changed from 70 cents to 90 cents per hour. Rule 21, Item No. 20, labor rate for repairing passenger equipment cars; changed from $1.10 to $1.30 per hour.

These labor charges, in addition to including the actual labor cost of performing the work, include the following items of indirect expense:

Wages of foremen, work inspectors, clerks, laborers, etc., working on freight repairs.

Proportion of the expense of operating power plant and of wages of shop or gang foremen, shop clerks, etc., whose time is not charged direct to freight repairs.

Shop switching, including repairs, depreciation, interest, taxes, fuel, lubrication, water, other supplies, fuel station and enginehouse expenses, wages of enginemen and firemen, switch crews and switch tenders.

Proportion of salaries and expenses of G. S. M. P. and M. clerks, S. M. P. and M. and clerks, master mechanics and clerks and general foremen.

Circular III-168 increases the limits for labor in Rule 120, as shown in Supplement No. 1 to the 1919 Rules of Interchange, issued March 1, 1920, to conform with the increase in the labor rate for car repairs, as shown in Supplement No. 3 to the 1919 Rules and Circular No. 166, effective September 1, 1920:

Rule 120. Repair limits for labor:

REFRIGERATOR CARS	
Wooden, with trucks of less than 60,000 lb. capacity	$108.00
Wooden, with trucks of 60,000 lb. capacity and over	180.00
Wooden, with trucks of 60,000 lb. capacity and over, equipped with metal draft arms extending beyond body bolster, continuous metal draft arms, transom draft gear, metal center sills, or steel underframe	270.00
HOUSE AND STOCK CARS	
Wooden, with trucks of less than 60,000 lb. capacity	45.00
Wooden, with trucks of 60,000 lb. and over	108.00
Wooden, with trucks of 60,000 lb. capacity and over, equipped with metal draft arms extending beyond body bolster, continuous metal draft arms, transom draft gear, metal center sills, or steel underframe	225.00
All steel, or steel superstructure frame with steel underframe	315.00
GONDOLA AND HOPPER CARS	
Wooden, with trucks of less than 60,000 lb. capacity	45.00
Wooden, with trucks of 60,000 lb. and over	108.00
Wooden, with trucks of 60,000 lb. capacity and over, equipped with metal draft arms extending beyond body bolster, continuous metal draft arms, transom draft gear, metal center sills, or steel underframe	180.00
All steel, or steel superstructure frame with steel underframe	270.00
FLAT CARS	
Wooden, with trucks of less than 60,000 lb. capacity	45.00
Wooden, with trucks of 60,000 lb. capacity and over	72.00
Wooden, with trucks of 60,000 lb. capacity and over, equipped with metal draft arms extending beyond body bolster, continuous metal draft arms, transom draft gear, metal center sills, or steel underframe	180.00

In view of the fact that the Rules of Interchange as revised at the Annual meeting of the Section held at Atlantic City, June 9 to 16, 1920, will be issued in such a short time, no additional supplements will be issued to the 1499 Code.

Welding Society Decides to Form New York Section

The American Welding Society called a special meeting of its New York members on October 14, at the Engineering Societies building, for the purpose of forming a Metropolitan section of the society. About forty members were present at the meeting, which was presided over by Comfort A. Adams, past president of the society. Temporary officers were chosen and a nominating committee was appointed for the purpose of choosing permanent officers for the local section at its first regular meeting, held on October 25, at 4 p. m., in the same building. Sections of the society have already been formed in Philadelphia, Chicago, Cleveland and Pittsburgh. The New York section began its career with 125 members who have been transferred from the parent association to the local section.

MEETINGS AND CONVENTIONS

Master Boiler Makers' Association.—The thirteenth annual convention of the Master Boiler Makers' Association will be held at the Planters' Hotel, St. Louis, Mo., May 23 to 26, 1921, inclusive.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD ASSOCIATION, SECTION III—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

SECTION III.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

AMERICAN RAILROAD ASSOCIATION, SECTION VI.—PURCHASES AND STORES.—J. P. Murphy, N. Y. C., Collinwood, Ohio.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. B. Baker, Terminal Railroad, St. Louis, Mo.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, 1145 E. Marquette Road, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eisenman, 154 E. Erie St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411 C. & N. W. Station, Chicago.

CANADIAN RAILWAY CLUB.—W. A. Booth, 131 Charron St., Montreal, Que. Next meeting November 9. Paper on How to Heat Railway Buildings Economically will be presented by R. H. Black, Engineer Power Plant Construction, Grand Trunk Railway System, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago. Meeting second Monday in month, except June, July and August, Hotel Morrison, Chicago.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, secretary Federal Reserve Bank Building, St. Louis, Mo. Meetings first Tuesday in month at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Next meeting November 11, Hotel Iroquois, Buffalo, N. Y. Paper on Engine House Organization will be presented by E. R. Webb, M. M., M. C. R. R., St. Thomas, Ont. Annual dinner in the evening.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—W. P. Elliott, T. R. R. A. of St. Louis, East St. Louis, Ill.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Next meeting November 9. Annual banquet and election of officers. Musical entertainment, speeches by members, etc.

DIXIE AIR BRAKE CLUB.—E. F. O'Connor, 10 West Grace St., Richmond, Va. Next meeting November 8-9, Atkin Hotel, Knoxville, Tenn. Paper on Hand Brakes and Why They Should Be Maintained will be presented by M. S. Belk, General Air Brake Instructor, Southern Railway. There will also be a discussion on shop kinks; Recommended Practice as to Air Brakes as adopted by the A. R. A. and the Air Brake Association.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 702 East 51st St., Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Convention May 23 to 26, 1921, inclusive, Planters' Hotel, St. Louis, Mo.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Next meeting November 11. Paper on The Locomotive Terminal as an Operating Factor will be presented by L. G. Plant, Associate Editor, *Railway Mechanical Engineer*.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York. Next meeting November 19. Paper on Loss and Damage to Freight will be discussed.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgrebe, 623 Brisbane Building, Buffalo, N. Y. Meetings third Wednesday in month, Statler Hotel, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Meetings second Thursday in month, alternately in San Francisco and Oakland.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Meetings fourth Friday in month except June, July and August, American Club House, Pittsburgh.

ST. LOUIS RAILWAY CLUE.—B. W. Frauenthal, Union Station, St. Louis, Mo. Next meeting November 12. Paper on the Manufacture of Steel by the Cambria Steel Company will be presented. Motion pictures.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. R. R., Buffalo, N. Y.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, Chicago. Next meeting November 15.

PERSONAL MENTION

GENERAL

C. E. BROOKS, superintendent motive power of the Grand Trunk Pacific, with headquarters at Winnipeg, Man., has been appointed mechanical assistant of the locomotive department of the Canadian National and the Grand Trunk Pacific, with headquarters at Toronto, Ont. Mr. Brooks will assist S. J. Hungerford, vice-president, in mechanical matters and attend to other duties as assigned. G. E. Smart, general master car builder at Toronto, has been appointed mechanical assistant in the car department to assist Mr. Hungerford in mechanical matters also.

J. J. CONNORS, who has been appointed superintendent of motive power of the Denver & Salt Lake, with headquarters at Denver, Col., was born at Milwaukee, Wis., in 1860, and entered railroad service in 1875 in the shops of the Chicago, Milwaukee & St. Paul, at Milwaukee. During the next 43 years he served continuously with the St. Paul, being promoted successively to foreman, general foreman, master mechanic and assistant superintendent motive power. In 1918 Mr. Connors became general superintendent of the Morrison Foundry Company, the position he held at the time of his recent appointment.

ROBERT D. HAWKINS, who has been appointed general superintendent of motive power of the Atlantic Coast Line with headquarters at Wilmington, N. C., as noted in last month's issue, was born on May 22, 1873, at La Fayette, Ind. He graduated from the School of Mechanical Engineering at Purdue University in 1893. He began railroad work in August, 1899, with the Great Northern as chief draftsman. Afterwards he became mechanical engineer, then general master mechanic and later assistant superintendent of motive power. He was promoted to superintendent of motive power on March 10, 1910, and retained that position until October 20, 1917, when he entered military service and was commissioned lieutenant-colonel, being assigned to Russia with the Railway Engineers. While in Russia he was given command of the Mechanical Section of Railway Engineers under the command of Colonel Emerson. He returned to the United States on January 5, 1920, and was appointed an assistant to the president of the Great Northern, doing special work in connection with mechanical matters. He held that position until his recent appointment.

R. D. Hawkins

CHARLES JAMES, mechanical superintendent of the Hornell region of the Erie with headquarters at Hornell, N. Y., has been transferred to the Ohio region with headquarters at Youngstown, O., succeeding A. G. Trumbull, resigned. F. H. MURRAY, shop superintendent at Susquehanna, Pa., has been appointed to succeed Mr. James and J. Topp, general foreman at Susquehanna, has been appointed Mr. Murray's successor.

M. SHEFFER, road foreman of engines on the Chicago, Great Western, with headquarters at St. Paul, Minn., has been appointed trainmaster of the Northern division, with the same headquarters, succeeding G. J. CONGDEN, who has resigned. A. K. ROWE succeeds Mr Sheffer.

CHARLES WHEELER, whose appointment as supervisor of fuel and locomotive performance of the New York Central, with headquarters at Buffalo, N. Y., was announced in the *Railway*

Mechanical Engineer for August, was born on September 6, 1881, at Clyde, N. Y. He attended the Clyde High School and entered the service of the New York Central on April 1, 1901, as a fire cleaner. On September 1, 1901, he was promoted to engine watchman and in October, 1902, became a locomotive fireman. In February, 1907, he was promoted to locomotive engineman; in April, 1909, was appointed division air-brake inspector; and in May, 1918, road foreman of engines. He held this latter position until July 16, 1920, when he was appointed to his present position.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

T. M. Allison has been appointed road foreman of engines on the Northern Pacific, with headquarters at Pasco, Wash., succeeding C. A. Wirth, whose promotion to master mechanic, with headquarters at Pasco, was announced in the September issue.

C. L. Emerson, division master mechanic of the Chicago, Milwaukee & St. Paul, with headquarters at Perry, Ia., has been transferred to the Chicago terminal, with headquarters at Chicago. Mr. Hopper will succeed at the Chicago terminal F. Hopper who has resigned.

R. C. Hempstead, division master mechanic of the Chicago, Milwaukee & St. Paul, with headquarters at Madison, Wis., has been transferred to the Kansas City division, with headquarters at Ottumwa, Iowa, succeeding C. W. Taylor, who has been assigned to other duties. W. C. Kenney succeeds Mr. Hempstead at Madison.

T. S. Lowe has been appointed assistant master mechanic of the Canadian National Railways at Montreal, succeeding John M. Kerr, transferred.

E. H. McCann has been appointed master mechanic of the eastern division of the Chicago Great Western, with headquarters at Stockton, Ill.

James Simpson, whose promotion to general master mechanic of the Northern Pacific lines, west of Paradise, Mont., with headquarters at Tacoma, Wash., was announced in the September issue, was born at Shrewsbury, England, on September 26, 1859. He entered railroad service in 1879 as a machinist apprentice in the shops of the Michigan Central at Jackson, Mich. From March, 1883, when he became a machinist at Brainerd, Minn., Mr. Simpson has been continuously in the service of the Northern Pacific. In 1885, he was transferred to Mandan, N. D., where he was employed as machinist until 1890, when he was promoted to night foreman, with headquarters at Jamestown, N. D. Three years later he was appointed machine shop foreman at Mandan and he was later transferred to Fargo, N. D. In 1897 he was promoted to general foreman at Mandan and afterwards was transferred to Staples, Minn. In June, 1907, he was promoted to master mechanic with headquarters at Dilworth, Minn. He was transferred to Livingston, Mont., in 1912, and in October, 1918, was appointed master mechanic of the Idaho division, with headquarters at Spokane, Wash., the position he held at the time of his recent promotion.

SHOP AND ENGINEHOUSE

A. B. Clark, master mechanic on the Southern division of the Chicago Great Western, with headquarters at Des Moines, Iowa, has been promoted to superintendent of shops, with headquarters at Oelwein, Iowa, succeeding M. H. Oakes. H. Brinkman succeeds Mr. Clark.

G. Lamberg, whose appointment as shop superintendent of the Chicago, Milwaukee & St. Paul at Minneapolis, Minn., was announced in the September issue, was born on May 18, 1874, in Sweden. He attended the high school at Waukesha, Wis., and entered the employ of the Atchison, Topeka & Santa Fe on February 1, 1891, as a machinist apprentice. From 1896 to 1897, he worked as a machinist for the Chicago Great Western at St. Paul, Minn., when he was promoted to gang foreman. In 1899 he entered the employ of the Great Northern at St. Paul as a machinist. In 1903 he was promoted to roundhouse foreman at Larimore, N. D., and in 1904 became gang foreman at St. Paul. In 1908 he was promoted to shop superintendent at Havor, Mont. In February, 1909, he entered the service of the Chicago, Milwaukee & St. Paul as a machinist at Minneapolis. In 1910 he was appointed assistant roundhouse foreman; in 1912, gang foreman; in 1914, machine shop foreman, and in 1918, general foreman. On September 1, 1919, he became division master mechanic of the Aberdeen division at Aberdeen, S. D., which position he held until his recent appointment.

John Todd, shop superintendent of the Erie at Susquehanna, Pa., was born on December 18, 1886, at Glasgow, Scotland. He graduated from the high school at Cornell, N. Y., and, in December, 1908, entered the service of the Erie as a machinist. On September 30, 1909, he became machine foreman at Galion, O., and on November 1, 1911, was transferred to Marion, O. On November 1, 1912, he was transferred back to Galion as machine and erecting foreman. On October 1, 1916, he was promoted to general night foreman at Port Jervis, N. Y., and on February 1, 1917, he became general foreman at Marion, O. On June 1, 1919, he was transferred to Susquehanna, Pa., where he held the position of general foreman until his recent appointment as shop superintendent.

PURCHASING AND STOREKEEPING

U. K. Hall, general storekeeper of the Union Pacific, with headquarters at Omaha, Neb., has been appointed general supervisor of stores of the Union Pacific System, with the same headquarters. This is a newly created position having to do with the development of policies, the organization and plans to be followed, in a general way, by the stores organization of the Union Pacific System. The actual details of the plans to be followed out will be executed by the general storekeepers of the units comprising the system so that the general supervisor of stores will act only in an executive and directing capacity, reporting directly to the assistant to the president. Mr. Hall's entire career has been with the lines comprising the Union Pacific System, with the exception of eighteen months spent in Washington as associate manager of the Stores Section of the Railroad Administration. Mr. Hall was born in 1878 at Portland, Ore., and entered the employ of the Union Pacific System in 1897 as an office boy in the office of the purchasing agent. In 1899 he was transferred to the stores on construction work and in 1900 to the accounting department, occupying various positions on roadway, engineering and stores accounts. In 1904 he returned to the stores department and in 1912 was promoted to the position of general storekeeper of the Oregon-Washington Railroad and Navigation Company at Portland. In 1916 he was transferred to Omaha as general storekeeper of the Union Pacific. He will be succeeded in this position by O. Nelson, traveling storekeeper with headquarters at Omaha.

William W. Morris, who has been appointed purchasing agent of the Northwestern region of the Pennsylvania System, with headquarters at Chicago, succeeding I. B. Thomas, was born in Philadelphia, Pa., on October 3, 1879, and entered railroad service as a clerk in the general offices of the New York, Philadelphia & Norfolk, at Philadelphia, on November 1, 1896. In 1898 he became clerk to the secretary of the Norfolk & Portsmouth Belt Line. in addition to his duties in the office of the president of the New York, Philadelphia & Norfolk. Four years later he was made chief clerk in the purchasing department of the New York, Philadelphia & Norfolk, and at the same time became chief clerk to the auditor of the Norfolk & Portsmouth Belt Line. In January, 1909, when the New York, Philadelphia & Norfolk was taken over by the Pennsylvania, he was transferred to the purchasing department of the latter road, with headquarters at Philadelphia, where he remained until February, 1918, when he accompanied Samuel Porcher, purchasing agent of the Pennsylvania Railroad, to Washington. During his service with the Railroad Administration, Mr. Morris was made secretary to the Central Advisory Purchasing Committee, and later, when that committee was abolished, became assistant to the Director of Purchases. When the roads were returned to private control, on March 1, 1920, he returned to the Pennsylvania as assistant to the general purchasing agent, with headquarters at Philadelphia, the position he held at the time of his recent promotion.

E. V. Reinhold, assistant to the manager of purchases and stores of the New York Central Lines, with headquarters at Buffalo, N. Y., has been appointed assistant purchasing agent, in charge of fuel, of the New York Central Railroad, with headquarters at New York.

SUPPLY TRADE NOTES

Horace B. Hench, vice-president of Templeton, Kenly & Co., Ltd., Chicago, has resigned.

The Easton Car & Construction Company, Easton, Pa., has opened a branch office in the Railway Exchange building, Chicago.

F. Rodger Imhoff, field engineer at Detroit, Mich., for the Precision & Thread Grinder Manufacturing Company, Philadelphia, Pa., has been appointed sales manager.

A. E. Harrold has been appointed manager of railway sales of the Willard Storage Battery Company, with headquarters at Cleveland, Ohio. Mr. Harrold was born on February 19, 1883, and is a graduate of the electrical engineering course of the Pennsylvania State College. From 1907 to 1908 he served as assistant instructor at the Massachusetts Institute of Technology, and then for three years as director of the testing section of the National Lamp Works of the General Electric Company. From 1911 to 1914 he was electrical engineer of the Wood & Spencer Engineering Company, Cleveland, and since 1914 has been employed by the Willard Storage Battery Company as manager of its stationary battery department.

A. E. Harrold

Fred J. Passino, assistant district manager of the New York territory of the Independent Pneumatic Tool Company, Chicago, has been appointed district manager at Fittsburgh, Pa.

Clarence C. Brinley has joined the Conveyors Corporation of America as eastern manager of the trolley carrier department and will be attached to the New York office, 110 West 40th street.

Arthur F. Wallace, for many years prior to the war, manager of the Economic Machine Company, Worcester, Mass., has been appointed sales manager of the Metal Saw & Machine Company, Inc., Springfield, Mass.

The American Car & Foundry Company, Madison, Ill., has awarded a contract to the Wimmer Construction Company, St. Louis, Mo., for a new one-story spring works building, to cost approximately $50,000.

R. G. Berrington, formerly with the Cleveland Twist Drill Company, is now Cleveland sales manager for the Reed-Prentice Company, the Becker Milling Machine Company and the Whitcomb-Blaisdell Machine Tool Company.

Carl J. Schmidlapp and Allan A. Ryan have been elected members of the board of the Chicago Pneumatic Tool Company, New York. Mr. Schmidlapp takes the place of A. F. Cassidy and Mr. Ryan fills a vacancy that had existed in the board for some time.

M. A. Kretchmar, chief lubricating engineer of the Sinclair Refining Company, Chicago, has become associated with the Horrocks Company, Herkimer, N. Y., as supervising engineer in charge of equipment and sales promotion work. The Horrocks Company manufactures the Danight lubricator.

The Keith Railway Equipment Company, Chicago, is completing a new steel freight car shop at Hammond, Ind., which involves an expenditure of $300,000. The extension will give to the company complete facilities for building and repairing both steel and wooden freight cars, and tank cars.

E. Payson Blanchard, a mechanical engineer, for several years advertising manager of the Boston Fressed Steel Company, Worcester, Mass., has resigned to go with the Bullard Machine Tool Company, Bridgeport, Conn., where he will take a shop course before entering the sales and advertising departments.

F. F. Fitzpatrick, president of the Railway Steel-Spring Company, New York, has received the decoration of Officer of the Crown of Italy. This order was founded in 1868 by King Victor Emmanuel II and is given as a reward for signal merit to military officers and others who have performed distinguished service in Italy.

The Lancaster Steel Products Corporation, Lancaster, Pa., recently opened a New York office in the National Association building, 25 West Forty-third street. The office is in charge of L. E. Vesey, as district sales manager. Mr. Vesey, for the past year and a half, has been in the Chicago office of this company.

The Norton Company, Worcester, Mass., has opened a branch office for its grinding machine division in room 304 Fenway building, 241 North Pennsylvania avenue, Indianapolis, Ind., under the direction of Walter F. Rogers, district representative. The establishment of this branch office will in no way affect the distribution of Norton grinding wheels. These will be handled as in the past by the Vonnegut Hardware Company.

A. L. Whipple has been appointed representative of the Locomotive Stoker Company, Pittsburgh, Pa., with offices at 50 Church street, New York. In 1888 Mr. Whipple entered the service of the Fitchburg Railroad, of which he was later assistant to the purchasing agent. He subsequently served as assistant superintendent of the Hoosac Tunnel & Wilmington Railroad, from which position he entered the railway supply field as representative of the Boston Woven Hose & Rubber Company, and then went to the Curtain Supply Company, Chicago, as general sales agent. In 1907, he was sales manager for Forsyth Brothers Company, Chicago, and in 1913, vice-president of the Standard Heating & Ventilating Company. Mr. Whipple served as entertainment committee chairman of the Master Mechanics' and Master Car Builders' conventions in 1904 and 1905, and vice-president of the Railway Supply Manufacturers' Association in 1908. Before becoming connected with the Locomotive Stoker Company he was vice-president and acting general manager of the Railway Improvement Company, New York City.

A. L. Whipple

The Skinner Chuck Company, Inc., New Britain, Conn., has recently adopted a new trade mark. It shows an alligator in the form of the letter "S," superimposed on a solid black circular background, with the words "Skinner Chucks" around the outside. The alligator was chosen as the symbolic figure best suited to the exploitation of Skinner Chucks, because the alligator is famous for its wonderfully strong jaws and long life.

The Safety Car Heating & Lighting Company and the Pintsch Compressing Company have removed their sales service, treasury and engineering departments from 2 Rector street, New York, and the purchasing, accounting and manufacturing departments from Jersey City, N. J., to their new plant at the corner of Dixwell and Putnam avenues, New Haven, Conn. The executive offices and sales office for the northeastern district will be located at 2 Rector street, New York, as heretofore.

R. A. Bull, vice-president of the Duquesne Steel Foundry Company and former president of the American Foundrymen's Association, has resigned to become consulting metallurgist for the Electric Steel Company, Chicago; Fort Pitt Steel Castings Company, McKeesport, Pa.; Isaac G. Johnson Company, Spuyten Duyvel, N. Y.; Lebanon Steel Foundry Company, Lebanon, Pa.; Michigan Steel Castings Company, Milwaukee, Wis.; and the Sivyer Steel Castings Company, Milwaukee, Wis.

The St. Louis Pump & Equipment Company, engineers and manufacturers, has been organized, with headquarters at St. Louis, Mo., to manufacture and install liquid handling equipment, specializing in units for gasoline and oil, measuring devices, etc., especially adapted to railroad and industrial use. The company has opened executive offices in the International Life building and temporary factory space has been secured in the western industrial section of St. Louis. C. C. Fredericks, of Ft. Wayne, Ind., has been elected general manager, and John C. Roberts, Jr., is president. Others affiliated with the company are: Willard D. Smith, Sherwood Hines and J. S. Farrell.

C. H. Jackman has been appointed sales agent of the Pressed Steel Car Company and Western Steel Car & Foundry Company, western district, with headquarters at Chicago. Mr. Jackman was born at Crystal Lake, Ill., on May 5, 1893, and was educated at the University of Illinois, graduating in 1916. He entered the employ of the American Bridge Company at Gary, Ind., as a draftsman in the master mechanic's department. Later he was with Joseph T. Ryerson & Son, Chicago, as estimator and sales correspondent until December 10, 1917, when he enlisted in the Air Service, U. S. A. After completing the army's course for pilots, he was commissioned Second Lieutenant, R. M. A. Upon receiving his discharge from the service, he returned to Joseph T. Ryerson & Son as special steel salesman, where he remained until his recent appointment as sales agent of the Pressed Steel Car Company and the Western Steel Car & Foundry Company.

American Car & Foundry Company

W. H. Sanford, for many years district manager of the Buffalo, N. Y., plants of the American Car & Foundry Company, New York, has been appointed assistant vice-president in charge of sales in the Buffalo district. This is in connection with the company's plan of extension in that district.

Prior to the formation of the American Car & Foundry Company, Mr. Sanford was employed by the Union Car Company, and when that company was absorbed he was appointed paymaster and cashier at the Depew plant. In 1902 he was appointed local auditor of the Buffalo district, followed by promotion to the position of resident representative. In 1912 he was made district manager in charge of the Depew and Buffalo plants.

Mr. Sanford has been succeeded as district manager by Andrew H. Gairns, who was district manager of the company in Chicago. He will direct the operation of the new plant in Buffalo, also the foundries located there and the plant at Depew. Mr. Gairns has had an extended experience in steel car work and locomotive building and is well qualified to take up the duties demanded by the Buffalo district.

The company's new plant now under construction in Buffalo will be used for building all-steel cars, with a capacity for turning out 20 to 30 cars a day. It will be equipped with the most modern machinery and labor-saving devices known, and there will be a number of features introduced which are entirely new and novel to the car building industry. In addition to the new car-building plant, a modern up-to-date office building will be erected on property recently acquired across Babcock street. The grey iron foundry at the Buffalo plant has been completely re-equipped and is now engaged in quantity production. The Niagara wheel department has also been brought up to a high state of efficiency.

At Depew, during the recent war, the company was the largest producer of 155 mm. shells. Immediately following the armistice, the entire Depew plant was reconstructed and is now capable of building 20 cars a day. E. G. Englehart is assistant district manager at Depew in charge of operations at that place, reporting to Mr. Gairns.

The car company's plans, as outlined above, involve a total expenditure of $3,500,000. With the developments that have taken place, the car company becomes one of the largest manufacturing operations in Buffalo and vicinity.

TRADE PUBLICATIONS

Temperature Controllers.—A small illustrated folder has been issued by the Foxboro Company, Inc., Foxboro, Mass., describing in detail their automatic temperature controllers.

Steel Lockers and Shelving.—The Van Dorn Iron Works Company, Cleveland, Ohio, has issued a pamphlet illustrating and describing the Van Dorn steel lockers and Van Dorn Simplex shelving.

The Oxygraph.—The Davis-Bournonville Company, Jersey City, N. J., has issued a new bulletin showing some details of their No. 1-A and No. 2 mechanically operated cutting torches for cutting steel up to 20 in. thick.

Link Belt Silent Chain Drives for Cement Mill Equipment.—The Link-Belt Company, Chicago, has ready for distribution a 32-page book, No. 345, which gives and substantiates reasons why the Link-Belt drive is ideal for operating ball mills, tube mills, conveyors, etc.

Price List.—Catalogue B-20 issued by the Armstrong Bros. Tool Company, Chicago, Ill., embodies and makes effective many changes in the list prices of the company's products. Attention is also called to the following additions to their line: Spring Threading Tool, Knurling Tool (3 new sizes), Bent Tail Heavy Duty Lathe Dogs, Aero Tappet Wrenches and Ford Wrench Sets.

Belt Lacing.—Under the title "Short Cuts to Power Transmission" the Flexible Steel Lacing Company, Chicago, has published a practical manual of belting practices. After discussing the factors to be considered in buying belts and describing the more important types in general use, the booklet covers the care of belts and the application of lacing. Valuable information concerning belt speeds, power transmitted, and the cause of belt trouble is given.

Balanced Draft.—"Modern Practice in Combustion Control" is the title of a booklet which has been issued by the Engineer Company, New York. This booklet contains 28 pages of interesting and instructive data of particular value to those interested in combustion. The science of combustion is treated at some length and consideration is given to some of the elements of combustion control. The principles of balanced draft and its many advantages are explained at length. A description of the apparatus and operation of balanced draft is given.

Water Softeners.—"Reap As The Harvester" is the title of a booklet published by the Graver Corporation, East Chicago, Ind., which describes the installation of Graver water softeners at the plant of the Wisconsin Steel Company and the savings effected by their use. In the second part of the book, the construction and operation of the Graver hot-process water softener is described. An interesting feature of the book is the series of artistic drawings of ore docks, blast furnaces and other equipment used in the manufacture of iron and steel.

Nonpareil Insulating Brick.—A 72-page illustrated book on the insulation of high temperature industrial equipment, such as boilers, furnaces, stills, hot blast stoves, ovens, kilns, etc., has been issued by the Armstrong Cork Company, Pittsburgh, Pa. The results of a study, from both theoretical and practical standpoints, on the subject of heat insulation compiled in this book make it a valuable and instructive treatise. It is conveniently divided into sections, each section dealing with a particular type of industrial apparatus.

Machinery Quarterly.—The first issue of the Machinery Quarterly by Joseph T. Ryerson & Son, Chicago, is now ready for distribution. This book is not intended as a complete machinery catalog, but does contain descriptive matter covering the line of equipment manufactured or sold by the Ryerson company. One or more machines or tools of each of the various classes are shown accompanied with brief descriptions and specifications. If the size or type of machine particularly desired is not shown, an illustrated bulletin with complete description and specifications will be forwarded on request.